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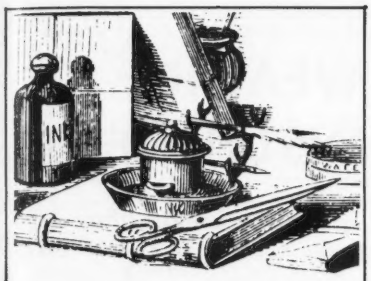

LETTERS

July 26, 1960

George Decker's article on insecticides and their use in the 20th Century, (*AIBS Bulletin* April, 1960) is an excellent presentation of the agricultural entomologist's viewpoint on this controversial subject. One can find little to criticize either in the logic of his argument or the general conclusions reached, in so far as they relate to the production of human foods. There are, however, some apparent implications inferring blanket approval of the widespread application of insecticides which deserve comment, in view of the current controversy between bird lovers and control agencies. Knowing Dr. Decker as I do, I feel sure that these implications were not intended, and were the natural result of time and space limitations that prevented adequate coverage of a very complex subject. This letter to the editor is written, not to criticize but rather to amplify and clarify.

We must agree that insecticides will continue to be used, perhaps in increasing quantities, in the artificially simplified environment of our fields, gardens and orchards. This seems inevitable. We have no desire to eat wormy apples, and most of us object to too many aphids in our spinach. Furthermore, one would encounter difficulty in persuading the potato grower to desist from using insecticides when he has seen per acre production rise from 75 to 500 or even 1000 bushels as a result of his use of agricultural chemicals, of which insecticides and fungicides are outstandingly important.

But when we depart from the fields and orchards, conditions are by no means comparable. The widespread application of poisons cannot be justified by the fact that the use of these chemicals on farms is necessary. Most of the controversy about the use of toxicants is centered around projects involving large areas, often under multiple ownership. Usually the projects which are questioned are conducted by public agencies, municipal, state, or federal, and therefore are not subject to regulations that apply to projects conducted by individuals or corporations.

Decker points out correctly that DDT has received a tremendous amount of research attention and he seems to imply that all insecticides have been subjected to similar careful scrutiny before they are approved for use. Actually, DDT is the only cholorinated hydrocarbon insecticide that has been adequately evaluated in terms of side effects on many organisms that are either of direct value to man, or appreciated for their beauty or aesthetic value. The widespread use of toxicants cannot be justified until small scale tests have proved their worth and their shortcomings. That is the reason that forest entomologists, while experimenting with other materials on a limited scale, have used only DDT on extensive projects.

We know that DDT used at dosages greater than one or possibly two pounds per acre may cause injury to certain terrestrial organisms. ½ pound per acre or even less may cause serious damage to fish. Why unexpected mortality of fish from low dosages sometimes happens is difficult to explain, especially when the mortality is delayed until several months or more after spraying. Possibly the death of organisms on which they feed results in malnutrition of fish, but more likely the toxicant is concentrated in the bodies of organisms used by fish for food. We know this to be true in the case of earthworms feeding on materials contaminated with insecticides of the chlorinated hydrocarbon family, and that robins feeding upon such worms are poisoned (Barker, 1958). The cherry orchardist may be happy about the reduction in the robin population, but others may not be.

The question of when, how, and where to use insecticides on a widespread scale is not easy to answer. Decker suggested that benefits to be derived should be weighed against the damage that may be done. Obviously this evaluation should not be entrusted to individuals or organizations which will do the actual control work and thereby stand to benefit. Sincere though they may be, such people are likely to be biased in viewpoint, and unwise decisions may result. The recklessness with which insecticides have sometimes been applied by public agencies, especially municipalities, for the control of the Dutch elm disease is a good illustration of carelessness. Dosages have ranged

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from one pound to over 100 pounds of DDT per acre. In one locality with which I am personally acquainted a private operator sprays the elms at so much per tree per treatment, and instead of one treatment when the trees are dormant and birds are least likely to be injured, three treatments are applied, thus tripling the income of the operator, but causing needless injury to birds. The residents, whose trees are sprayed without their direct authorization, are charged personally for the work.

Decker inadvertently infers by the photograph of elms in his article that economic entomologists approve without reservation the Dutch elm disease spraying prgram, as it is conducted. This is not altogether true because we know that the disease cannot be controlled by spraying alone, as Decker and his associates have elsewhere pointed out. (I.N.H.S.) The difficulties encountered in controlling the Dutch elm disease are evident on the campus of The University of Illinois, where, in spite of spraying, the elms have died in great numbers, not only from the elm diseases but from the scale insects which almost always increase following the application of DDT. Control of the Dutch elm disease can only be accomplished by intelligent use of insecticides combined with sanitation. Furthermore, sanitation does not mean merely the prompt removal of dead wood, as we are inaccurately told by control agencies, but rather the prompt removal of dying or recently killed branches and dying trees, regardless of the cause of mortality, before the elm beetles have had a chance to breed in them. The beetles cannot breed in trees or branches that have been dead long enough for the inner bark to have become darkened, and without the bark beetles the Dutch elm disease would be without its primary means of dissemination. These facts have almost never been fully publicized by those responsible for the Dutch elm disease control on the local level.

The actual decision to spray or not to spray is all too often in the hands of inadequately-trained men, who can only see the pros. The Dutch elm disease situation is only one illustration of this. We need some provisions that will assure wise and dispassionate decisions on whether or not the broadcast use of an insecticide is justified in a specific instance.

Decker may seem to imply that insecticides must always be the "backbone" of insect control, although he recognizes that cultural practices and natural enemies of insects are helpful. Some of us feel that other means of insect control are even more important than insecticides, especially in forests, and judging from the research program under his supervision Decker himself is among these. Some research even in orchards, has shown that in certain localities proper selection and timing of insecticidal applications can increase the effectiveness of natural enemies in limiting the multiplication of some pests. The result is a material reduction in the amount of toxicants needed. (Pickett, 1956) Much more ecological work along this line should be encouraged.

Admitting, as we must, that the use of toxicants is essential to man's well-being, we need not assume that broadcasting these poisons is the best way to apply them. Widespread application from the air is spectacular and attractive because it makes news, but it inevitably entails a certain amount of risk. Fortunately we have some researchers looking for safer ways of using toxicants; among them are F. S. Arant and Sidney Hays in Alabama who are developing a technique for poisoning the imported fire ant that seems safe. The "catch" is that the technique must be applied by individuals who wish to control the ants on their property, and not by the widespread and spectacular treatments under federal aid, so attractive to some public agencies.

Unfortunately space does not permit the enumeration of other work leading toward the safer application of insecticides, but fortunately considerable effort is being directed along this line. These efforts should be encouraged.

I have raised a question concerning the wisdom of the Dutch elm disease program as currently conducted. Now let us look at the fire ant situation. We know that the toxicants used in the broadcast applications to "eradicate" this insect are highly destructive to some birds and mammals. That this is recognized by proponents of the program is indicated by the warnings issued. These include, covering of fishponds, keeping pets and small children off treated ground for a certain length of time after treatment, covering leafy vegetables in the garden, and preventing pets from drinking from pools of water standing after a rain.

Only a major emergency could justify a widespread program that requires such precautions. Can the fire ant be so classified? Many entomologists think not. In fact it appears from personal conversation with one entomologist who has studied the insect intensively, that the fire ant is chiefly a nuisance. On the credit side it is highly predatory upon other insects such as the cotton boll

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weevil and boll worm. Furthermore, it appears to be less destructive to ground nesting birds than is our native fire ant, which it seems to be replacing, and with which we have lived for generations. These facts cause us to wonder whether or not the pros and cons were carefully weighed before the fire ant program was undertaken.

Also, the program to eradicate the gypsy moth is open to question. Would it be practicable to eradicate this insect? Most forest entomologists who are acquainted with the situation believe not. I do not question the sincerity of those who proposed the project, but I do question their judgment and their competence to weigh the pros and cons. In support of this viewpoint, we in Michigan have been trying unsuccessfully to eradicate the gypsy moth from a small area around Lansing since 1954. If, after five or six years of spraying, a small infestation such as this has not been eradicated, what chance is there that the New York-New England program can succeed?

Some entomologists seriously question whether or not the eradication of *any* thoroughly established insect can be accomplished with means now at our disposal. The case of the Mediterranean fruit fly in Florida is often cited as an example of successful eradication, but actually the results there signify little if we accept Hopkin's (1938) conclusion that the climate in Florida is unsuited to the year in year out survival of the insect.

Still other widespread control projects supported by public funds might be mentioned, some justifiable and some not. But from the examples mentioned, the evidence is clear that enough mistakes have been made to raise questions concerning the infallibility of some publicly-supported insect control agencies.

My conclusion is this and I hope that Dr. Decker will agree: that the use of insecticides is a necessity for production of foods in the quantity and quality that we require. However, numerous widespread projects involving the broadcasting of insecticides that have been endorsed enthusiastically by the public-supported control agencies, are open to question. Apparently the decision to spray or not to spray cannot be safely left to these control agencies. The temptations of empire building are too great. The pros and cons should be weighed by persons with broad training and experience, who can evaluate all available information dispassionately, thus reaching a decision that will be in the best long-term interest of mankind and as nearly unbiased as possible. The viewpoint of forest entomologists on the broadcasting of insecticides deserves special comment because it is a sensible one. It is this: All agree that the application of insecticides over large areas must be regarded as an emergency treatment, comparable to extinguishing a fire or removing a man's appendix. Control projects involving the broadcasting of insecticides should not be entered upon lightly.

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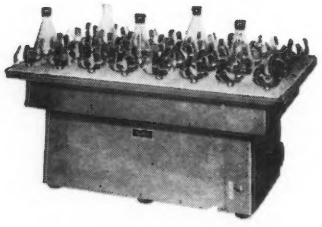

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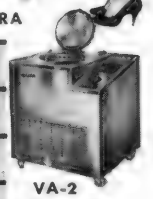
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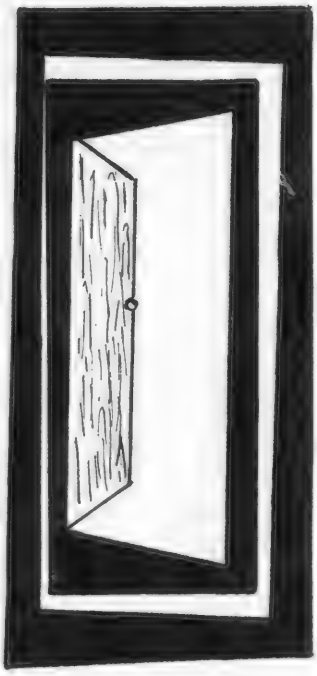

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Editor's Note . . . This Symposium was held at Gatlinburg, Tennessee, May 1-2, 1957 under the sponsorship of the American Institute of Biological Sciences with support from the National Science Foundation.

The Conference which these proceedings reflect is one expression of an apparently spontaneous resurgence of interest in the biology of aging. While the papers possess many understandable inadequacies, they constitute a clear testimony to the vigor of interest in the question: What are the basic mechanisms underlying the gross phenomenon of aging?

In addition to the revised and/or expanded versions of the papers submitted at the Conference, the present proceedings include somewhat revised verbatim transcriptions of the discussions which are the real heart of these proceedings.

TABLE OF CONTENTS:

DISCUSSION SESSIONS—Definition and Universality of Agina; Mortality and Measurement of Aging; Molecular and Particulate Aging; Some Genetic Aspects of Aging; Comments on the Evolution of Aging; Developmental and Genetic Aspects of Aging; Cellular Changes: Structure, Metabolism, Cytology; Pathology and Aging; Methodology, Information Theory, Design and Approach. *ARTICLES*—**Approaches to Aging on the Molecular Level,** Norman G. Anderson; **Changes in the Structure of Cells, Tissues and Organs in the Aging Process,** Warren Andrew; **Age and Cellular Metabolism of Tissues,** Charles H. Barrow, Jr.; **Growth, Disease and Aging,** Benjamin N. Berg; **An Analysis of Some Radiation Effects on Mortality,** Nathaniel I. Berlin; **Species Differences in Potential Longevity of Vertebrates and their Physiological Implications,** Francois Bourliere; **General Aspects of Aging in Cells from a Physiological Point of View,** Geoffrey H. Bourne; **Acceleration of Aging by Ionizing Radiations,** George W. Casarett; **B_{12} Deficiency and Aging,** Bacon F. Chow; **The Study of Mortality in Population,** Alex Comfort; **Aging Effect of Toxic and Radiation Stresses,** H. J. Curtis and K. L. Gebhard; **An Analogy Between Probabilistic Automata and Living Organisms,** Murray Eden; **The Aging Process and Somatic Mutations,** G. Failla; **Fat Accumulation and Aging in Males and Females,** Stanley Marion Garn; **Evidence of Aging in Fishes,** Shelby D. Gerking; **The Influence of Immediate Versus Delayed Mating on the Life Span of Drosophila,** Bentley Glass; **Lengthening of Life Span in Mice in Relation to Two Deleterious Agents,** John W. Gowen; **The Properties of Some Soluble Components of Connective Tissue and the Influence of Growth Rate,** Jerome Gross; **Measurements of Developmental Parameters in the Chick Leg Musculature,** Heinz Herrmann; **In Vitro Aging of Erythrocytes,** F. M. Huennekens; **Enzyme Activities and Coenzyme Concentrations of Human Arterial Tissue and their Relation to Age,** J. E. Kirk; **Senescence of Plant and Plant Organs,** A. C. Leopold; **Frustrations of a Senescent,** C. M. McCay; **A Critique of Theories of Mortality,** Albert S. Mildvan and Bernard L. Strehler; **Immunological Reactions and Age,** I. A. Parfentjev; **Aging of Plants,** William J. Robbins; **Aging in Insects,** Morris Rockstein; **The Effect of Physiologic Fluctuations on Mortality and Aging,** George A. Sacher; **The Dimensionality of the Life Span,** George A. Sacher; **Analysis of Life Tables with Secular Terms,** George A. Sacher; **Age Changes in Physiological Functions in the Total Animal: The Role of Tissue Loss,** N. W. Shock; **Mortality in a Rat Colony,** Henry S. Simms; **Aging and Lability of Irreplaceable Molecules,** F. Marott Sinex; **Studies on the Measurement of Aging,** Harry Sobel; **Some Comments on the General Biological Situation with Regard to Aging,** T. M. Sonneborn; **Tests and Critique of Some Theories of Aging,** T. M. Sonneborn; **Physiological Basis of Aging in Paramecium,** T. M. Sonneborn and Myrtle Schneller; **Cellular Changes with Age in Paramecium,** T. M. Sonneborn and Ruth V. Dippell; **Age-Induced Mutations in Paramecium,** T. M. Sonneborn and Myrtle Schneller; **The Human Early Foetal Death Rate in Relation to Age of Father,** T. M. Sonneborn, **Enormous Differences in Length of Life of Closely Related Ciliates and their Significance,** T. M. Sonneborn; **Measures of the Rate and Amount of Aging on the Cellular Level,** T. M. Sonneborn and Myrtle Schneller; **Factors in Human Mortality,** Mortimer Spiegelman; **Fluctuating Energy Demands as Determinants of the Death Process** (A Parsimonious Theory of the Gompertz Function), B. L. Strehler; **Biochemical Investigation of the Aging Nervous System,** Eugene Streicher; **Ionizing Radiation and the Aging Process,** A. C. Upton; **Adaptation to Environmental Changes at Different Ages,** F. Verzar; **Biochemical Changes in Mitochondria Associated with Age,** Eugene C. Weingach; **Pleiotropy, Natural Selection, and the Evolution of Senescence,** George C. Williams; **The Use of Information Theory in Aging and Radiation Damage,** Hubert P. Yockey.

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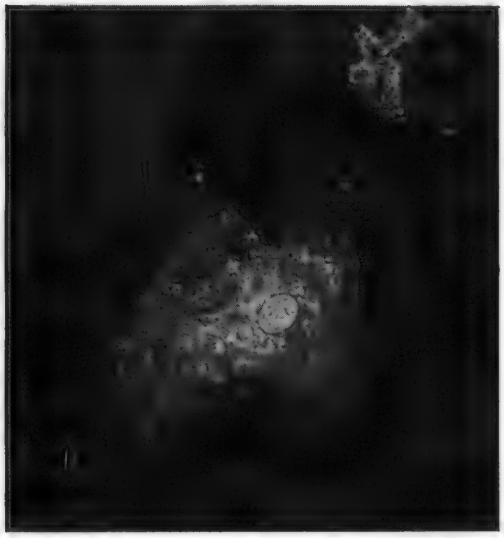

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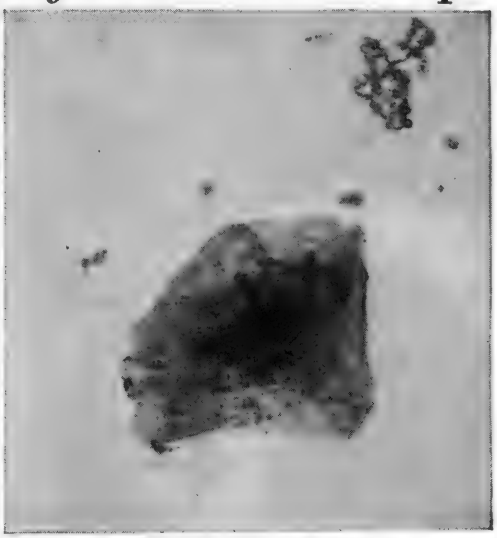

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EDITORIAL

Thoughts About Biology

Everything expands and changes and so does our knowledge of biology. Everybody says that this is so. Even though I have been a biologist only 30 years, still I have myself seen sufficient change in our science to be assured that such change is in fact taking place. In the first place we have learned a lot of plain old facts: How respiration works, a lot about how photosynthesis works (but not all), a lot about how all the different amino acids get made, a lot about what hormones there are, a little about how hormones work, a lot about the description of how development takes place, a great deal about genetic material. We have seen enough to convince me that there is one great class of biological problems which, if followed to its ultimate lair, turns out to be biochemistry. They are problems which ultimately revolve around the path of carbon, the isolation of enzymes, etc., etc. I think this is true of much of genetics, all of physiology, much of embryology, much of ecology, and, in a sense, of morphology and anatomy. These disciplines all deal with things that turn upon molecules and chemistry in a rather direct way. We know, for example, that to discover how a gene does what it does, all we have to do is find out what enzyme it causes to be made and then find out what that enzyme does.

It is perfectly clear, then, that if one wishes to tackle any of the biological problems of this class, he has to be a biochemist, and so the wise student will become a biochemist.

It appears to me that beyond this stratum of molecular biology, or above it, as some of my friends would say, is a second stratum; a stratum which contains problems of strategy, of programming, of how to use the various and ingenious molecular devices invented by creatures to make a creature or a society. To this class of problems I give the name "systems biology." The first and obvious example is the neural network made of cells, made of molecules, to be sure, but capable of, in some mystic way, processing, storing, retrieving, and acting on sensory information. The problem of how the neural network works has elements which are not intuitively obvious even if one were to know a great deal about neurobiochemistry. We want to know the logic which the neural network uses, the program which it uses for problem solving, and so on. This is a biological problem which is upon a level of abstraction higher than that of our neoclassical molecular biology. Or to cite another example, the successive acts by which sister cells differentiate to form a creature. This again appears to be a problem in programming—programming of the use of the information contained in the genetic material. Or the flux of material through a community of plants and animals, the strategy of who eats whom and why. Or the problem of why the photosynthetic unit has 2400 chlorophyll molecules instead of some other number.

These are problems which biologists by and large are not able to tackle profitably. In the first place they have in common the quality that their study requires not only knowledge of biology and of biochemistry but also knowledge of logic, information theory, network theory, and analytical mathematical ability. And it appears clear to me that the great forward steps in these complicated problems of biological systems analysis are being made not by formal biologists but by mathematicians, physicists, and even engineers whose interests have turned (probably for some sinister subconscious reason) to biology. And it should in turn be clear to any promising young person who wishes to solve complex problems of biology that he should start out by becoming, say, a physicist or a mathematician.

It appears to me that the frontiers of our knowledge in biology are advancing more rapidly than is the breadth of wisdom and interest of biology departments. More than ever before, it seems to me, we teach people the wisdom they need to solve yesterday's problems instead of tomorrow's. The biologist of today already needs much more wisdom in quantum chemistry and symbolic logic and systems analysis and basic physics than he ordinarily has at his disposal. But we do little to insure that the next generation of biologists will possess such skills and wisdom. Biology is becoming a rigorous science with sophisticated laws and operational rules and theorems and even a central dogma; it has everything but sophisticated instruction about how to become a biologist.

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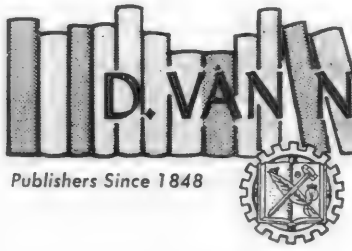

Some results of the Biological Sciences Curriculum Studies summer writing conference and a look ahead

Hulda Grobman

Consultant, BSCS

Progress At Boulder

THE Biological Sciences Curriculum Study (BSCS) was set up in January 1959, under the auspices of the AIBS Education Committee. Arnold B. Grobman, of the University of Florida, is Director of the Study, which has been financed by several National Science Foundation grants. While the BSCS has the broad function of contributing to the improvement of biological education at all levels, it has taken the high school biology area as its first point of focus and currently has four activities involving teaching of high school biology under way: 1) the preparation of new high school biology programs; 2) a historical study of biological education; 3) the laboratory block program; and 4) the gifted student program.

New High School Programs

During the summer of 1960, the BSCS held a Summer Writing Conference on the campus of the University of Colorado, with over sixty high school biology teachers and research biologists from all parts of the country, educators, psychologists, editors, and artists participating. The writers were divided into three teams. Each team produced a new high school biology program, including text, laboratory manual, and teacher's commentary. A group of 20 students at Boulder High School tried out the materials as they were prepared and discussed their reactions.

All three of these new programs have several common aims; to make clear to the student the nature of scientific inquiry, the intellectual history of biological concepts, genetic continuity, regulation, complementarity of structure and function, diversity, and many other similar important concepts. In addition, each is infused with such ideas as the quantitative approach, incertitude, aesthetics, limits of knowledge, speculation, temporal parameters, dynamic systems, and multiple variables.

However, a different approach to biology is used in each of the three versions. The Blue Version, under the supervision of Ingrith Deyrup of Barnard College, used as its central theme the development of the ideas and the experimental approach of physiology and biochemistry. The Green Version, under the supervision of Marston Bates of the University of Michigan, is built around a natural history or ecological approach to biology and stresses the essential inter-relatedness of living things. The Yellow Version, under the supervision of John A. Moore of Columbia University, uses a developmental and genetic approach. New laboratory materials for all versions were prepared under the supervision of Bentley Glass of Johns Hopkins University.

These three new programs are now being used on an experimental basis by 117 teachers with their first-year biology classes; one-third of the teachers are using each of the versions. Of these teachers, 105 are connected with 15 Testing Centers in different parts of the country, with six to eight teachers in each center; the remaining 12 teachers are in Independent Test Schools. In each Testing Center, one of the teachers is designated the Center Leader and is responsible for coordinating the activities of that Center. In addition, each Center has a college research biologist as Consultant, to advise on problems of biological content.

Because the BSCS texts and laboratory manuals represent a departure from traditional biology courses, specific efforts have been made to assure that teachers in the Testing Centers and Independent Test Schools are familiar with the goals of the project as well as with the biological concepts included in the three versions. First, all Testing Center Leaders and Center Consultants as well as all the teachers in Independent Test Schools participated in the BSCS Summer Writing Conference. Second, a six-day Briefing Session was held on the University of Colorado campus the last week of August for all teachers and Consultants using the BSCS materials this year. Third, throughout the school year, the teachers and Consultant in each Testing Center meet weekly to discuss the program.

The year-long experience of the high school teachers and their students in the BSCS testing program will determine the revisions to be made in the BSCS materials at the end of the year. Information on this

experience will be obtained in several ways: through reports from the Center Leader, through visits to the Testing Centers by BSCS staff members, and through tests administered during the year to all students using BSCS materials. Because the aims of the BSCS materials differ from those of traditional courses, new tests will have to be devised to determine the extent to which students are achieving these aims; the Educational Testing Service will work with the BSCS.

Current plans include a Second Summer Writing Conference in 1961 to revise the BSCS materials; these revised materials will then be tried out on a broader scale during the 1961-62 school year, with a final revision scheduled for the summer of 1962.

Study of Biological Education

In preparation for the secondary school projects of the BSCS, Paul deH. Hurd of Stanford University made an exhaustive historical study of high school biology education in the United States. The study examines the recommendations of national committees appointed since 1890, that have considered the problem of science education, with special reference to the secondary schools. It also reviews research studies in science education, analyzes books on the teaching of biology, and summarizes the problems, issues, and trends in the teaching of secondary school biology. Dr. Hurd's study will be published by the BSCS this winter.

The Laboratory Block Program

While the biology laboratory can provide an excellent medium for teaching, by giving an understanding of the nature of scientific inquiry and the process by which scientists work, often conventional laboratory experiences in high school biology do not exploit the full potential of the laboratory. The BSCS Committee on Laboratory Innovations, under the chairmanship of Addison E. Lee of the University of Texas, is experimenting with a new approach to laboratory work through the use of laboratory blocks. A high school biology class would use one block sometime during the year. A block takes a six-week period, during which the laboratory work, reading, discussion, and field activities center around a major biological topic. The work progresses through a series of related laboratory experiments, so that the student is given a laboratory experience in depth, and proceeds from simple to more sophisticated approaches than are generally provided in conventional laboratory exercises.

LEFT TO RIGHT: *Bentley Glass, Johns Hopkins University, Baltimore, Maryland and Herbert Zim, Tavernier, Florida.*

LEFT TO RIGHT: *J. D. Woolever, Riverview Senior High School, Riverview, Florida; C. Francis Byers, Elmira College, Elmira, New York; Gerald Einem, Melbourne High School, Melbourne, Florida; and Paul Vestal, Rollins College, Winter Park, Florida at the BSCS Briefing Session.*

Of the 12 laboratory block programs now planned, four have been completed: Plant Growth and Development; Microbes: Their Growth, Nutrition, and Interaction; Animal Growth and Development; and Interdependence of Structure and Function: a Study of Motion. During the spring semester, eight of the BSCS Testing Centers will use one of these blocks to supplement the BSCS course materials.

The Gifted Student Program

Under the chairmanship of Dr. Paul Brandwein, a six-man team of high school teachers and research biologists is preparing several types of materials to assist teachers in working with gifted students.

In addition, the committee has invited biologists from all over the country to submit brief outlines of suitable research projects for gifted students. Of some 500 projects suggested, 150 have been selected and are being edited for inclusion in an initial publication for use of students. Each of these research projects involves a problem for which solutions are not yet available in the literature. It is hoped that after the student completes his research investigation, the results will be edited by the BSCS Gifted Student Committee, returned to the student for his approval, and then submitted to an appropriate scientific journal for publication.

Current information on the BSCS activities is available in the BSCS quarterly NEWSLETTER, which is sent to interested persons free on request. To be placed on the mailing list of the NEWSLETTER write to: Director, BSCS, University of Colorado, Boulder, Colorado.

A report from a member of the BSCS Teacher Preparation Committee concerning a teacher certification study

Dorothy Matala

Iowa State Teachers College, Cedar Falls

Certification of Secondary School Teachers

FOR THE FIRST TIME in a number of years and perhaps for some years in the future, the biologists and other scientists of the country have an opportunity to influence the policies being established for the certification of teachers in the secondary schools of the nation. The Teacher Preparation Committee of the BSCS has become involved in the study of the certification of teachers of science and mathematics. As a member of that committee I should like to report what has been done and what is being planned.

With a grant from the Carnegie Foundation the AAAS and NASDTEC (the National Association of State Directors of Teacher Education and Certification) are during the present year conducting a study of the certification of secondary teachers of science and mathematics. Dr. John Mayor, Director of Education for the AAAS is director of the project and William Vial on leave from the New York Department of Public Instruction is the associate director. The project is planned by a board with representation from AAAS and NASDTEC. Dr. Bentley Glass and Dr. Ed Begle are the AAAS representatives.

The plan is to collect from as wide a group as possible suggestions regarding certification policy and practice which can be considered and synthesized into a report that will contain the recommendations from the study. To this end a series of 4 regional meetings were held in April of 1960 at Chicago, Atlanta, New York City, and Salt Lake City. These were followed by the NASDTEC meeting in June. It is hoped that in each state there will be meetings on the problem during the fall and winter of 1960-61. Recommendations and suggestions from all these meetings will be fed back to the NASTDEC meeting in June of 1961 when final results and recommendations will be prepared.

The Regional Meetings

Attendance at the regional meetings was by invitation. Individuals were selected to provide representation of most of the groups interested in and concerned with certification. Scientists nominated by the AAAS included physicists, chemists, biologists, and mathematicians. The Teacher Preparation Committee was among these with one or two members at each meeting. NASDTEC was represented by the member from each state within the region. The rest of the 40 to 50 people represented other organizations and groups who are interested in and concerned with teacher education, certification, and accreditation, such as TEPS, the American Association of Colleges of Teacher Education, the National Council for Accreditation of Teacher Education, the Organization of Chief State School Officials, and the accrediting agencies such as the North Central Association of Colleges and Secondary Schools. Thus, the regional meetings drew together diverse elements of those concerned about the training of teachers.

Each meeting was operated on the same general plan—general sessions for the airing of problems and opinions and groups sessions for each of the specific sciences and math for which certification may be asked. The general sessions met one evening and the following morning. In these the purpose and outline of the study was presented along with reports of some of the suggestions now being discussed and tried in specific areas or states. (Many of these had been sent to participants as working papers before the meeting.)

Smaller groups to consider the specific recommendations for each area—biology, chemistry, physics, and mathematics—met during the afternoon, evening, and the following morning. General Science was added at the recommendation of the Chicago group which met first. These smaller groups also had diverse representation. The report of each group was mimeographed, re-evaluated by the group, then presented to the entire conference for reaction. Recommendations from the groups were both specific and general. If the general recommendations met the approval of the entire conference they became so stated.

The results of the regional meetings reported here are my own impressions as a member of the Chicago meeting and from reading the reports from the other

conferences. The official summary report will be ready this fall. Further information and impressions can be found in the last issue (June) of *Science Education News*.

Among the working papers of the conference was the report of the recommendations on certification from the Cooperative Committee of the AAAS which has been discussing this problem for several years. This appeared in the February issue of the *American Biology Teacher* and the 8 April 1960 issue of *Science*. In general, the patterns of certification recommended in this were endorsed—more strongly by the physicists, chemists, and mathematicians than by the biologists. The hesitancy for stronger endorsement arose over whether or not it is desirable to list required hours in traditional areas of biology, will this make any change in what is taught in the colleges? There seemed to be little real question that a change is desirable—that we cannot expect secondary teachers to teach "modern biology" on what is the usual and traditional sequence of courses offered or required of them. The basic question being raised was whether or not the pattern of courses which has developed primarily to meet the needs of the pre-med student is the pattern that meets the needs of the secondary teacher.

An interest was expressed both by the biologists and the others concerned with certification in maintaining as flexible a program as possible. The feeling existed that stating required numbers of hours in specific courses or areas (area statements would become courses in the colleges) would reduce the possibility that requirements for the certification of teachers could be made to follow the development of the science easily. As a result, the requirements are stated in terms of competencies or understandings rather than in hours to be taken. The administration of such a program is more difficult so there may be slow acceptance of it. Further, it puts the colleges on the spot to make their programs produce the competencies. However, it also gives the colleges freedom to try new patterns of courses and new presentations. This desire to get away from the traditional courses even led to the suggestion that the area of competencies be listed by some other terms than anything that is as widely used as course titles. This has proved difficult because of inability to be sure that others understand what the terms adopted may mean.

The recommendations in biology are that half of the hours required for graduation be devoted to biology and related science. This in most schools will mean about 60 semester hours. The remainder of the time is to be devoted to general and "professional" education, about 1/3 to the former and 1/6 to the latter. The related science recommended is again in terms of understandings rather than hours or courses. In chemistry these should extend to biochemistry. (This raises the very real problem of the value of the traditional sequence of chemistry courses to the biology major.) In physics these should include the structure of matter, energy relations, etc. In mathematics they should go to those needed for genetics and population studies. In geology, enough to develop the background for the historical evidences of evolution. This makes a very full program of related sciences for the biologist and will require some close evaluation of the traditional courses and approaches.

The flexibility desired by all the regional groups may seem to some an impossibility with the certification techniques that have been traditional. This is being met in many states—an increasing number—with the "approved program plan" of certification. Under this plan a college wishing to prepare teachers plans a curriculum for the purpose and submits it to the state certifying officer for approval. If the program is approved certification becomes automatic upon recommendation of the college. This means that the college has the responsibility of deciding whether or not a specific student has adequate preparation for teaching. In our institution it also means that a committee of the Science Department must pass upon minors whose adequacy may be in question. So if students go out certified in science and insufficiently prepared we have only ourselves to blame. This is a soul-searching responsibility at times! But if we do not decide on the basis of our convictions then we have no one but ourselves to blame when the secondary teaching is poor. In states with this type of certification program—almost half of them—the scientists in the colleges must now either "put up or shut-up" on certification! Admittedly this often leaves problems within institutions. But even here the scientists should begin to make their interests and opinions felt.

State Follow-up

I have heard no reports of plans within the several states for the second phase of the study. At the regional meetings some discussion occurred as to the agency through which the follow-up should be made. It was felt that this must be left to the situation within the individual states. In many cases it will probably be the state TEPS organization that will assume the responsibility. In Iowa, with the blessing of our director of certification, the Iowa Academy of Science is conducting the state meetings as part of its 1960-61 program. Already existing committees on Science Teaching and certification have been given the responsibility for conducting the study. Plans are for 4 meetings in the state during the fall to which representation from each of the sciences from each of the colleges and junior colleges within the state will be invited. The general outline of program will follow that of the regional meetings. Suggestions and recommendations will be compiled for a report to the academy meeting next spring. If accepted by the Academy, these will be forwarded to the state certification officer. He has expressed pleasure that the science organization is willing to provide the recommendations. He already has such a statement from the English teachers and finds it very useful with colleges who want to let students by with less than the desirable training.

If biologists or other scientists are interested in contributing to the program within their states, I would suggest contact with the state director of certification for information about what is being planned. However I would make a plea for each interested person to go into the program with good will for others involved. This is not a problem to which the scientist alone, has or can find the best answer.

A plan that gives the young biologist an opportunity to try a professional or research career before graduation

W. L. Obold

Chairman, Department of Biological Sciences, Drexel Institute of Technology, Philadelphia, Pennsylvania

The Drexel Plan—Cooperative Education

IN ORDER to meet a growing demand for specialization in the biological sciences, there was inaugurated at Drexel Institute of Technology in the autumn of 1951, a five-year cooperative curriculum with a major in Biological Sciences. The curriculum comprises a course of general basic content supplemented by a sequence of selected subjects in the life sciences.

The cooperative plan of education had been operative at Drexel since 1919 in the College of Engineering and the College of Business Administration. Each year more than five hundred firms employ Drexel students. During the past few years students majoring in the biological sciences have been employed by the Institute for Cancer Research, the McNeil Laboratories, the Eastern Utilization Research Division of the United States Department of Agriculture, the Charles Pfizer Company, the National Drug Company, the Philadelphia Board of Education, the Richlyn Drug Company, the Rias Research Institute for Advanced Study, the Philadelphia County Board of Health, the Jefferson Medical College, the Frank H. Fleer Corporation, the Breuninger Dairies, the American Stores Incorporated, the Atlas Powder Company, the Rudd-Melikan Company, C. Schmidt and Sons Company Incorporated, and the United States Biological Warfare Laboratories, Fort Dietrick.

Career opportunities in the biological sciences are open to both men and women. The Drexel Plan of Cooperative Education offers the young biologist a chance to try a planned research or professional career "for size" before graduation. The industrial experiences and the classroom experience are balanced from the very beginning of the college program. After the freshman year, which is spent entirely in college, the student alternates periods of college with periods in industry. The assignments to industry are arranged by Drexel's Department of Industrial Coordination as an integral part of their college program. Students are paid the going rate in the company or institution in which they are placed. Often the student can be placed in a company in his home community and the student can live at home. It is possible for future biologists to accumulate up to 2 years of research, industrial, or teaching experience before graduation under the Drexel Plan.

Here is a typical schedule under the five-year cooperative program as required in the biological science curriculum.

Year	*Fall*	*Winter*	*Spring*	*Summer*
Freshman	College	College	College	Vacation
Sophomore	College	Industry	Industry	College
Pre-Junior	College	Industry	Industry	College
Junior	College	Industry	Industry	College
Senior	Industry	College	College	Graduation

Students for admission to Drexel's basic science courses take the examination of the College Entrance Examination Board in scholastic aptitude and the Scholastic Achievement Tests in English composition, chemistry or physics, and intermediate or advanced mathematics.

The curriculum in the Biological Sciences is designed to qualify graduates for careers in industrial, medical, and research laboratories as bacteriologists, biochemists, and life science specialists. Some students prepare for graduate studies leading to advanced de-

Basic Science Center, Drexel Institute of Technology

grees in specialized fields or a professional career in basic research as well as college and university teaching. Students preparing for teaching biological sciences in secondary schools may elect the specific courses in education needed to meet the certification requirements. The cooperative basic science curriculum covers eleven terms of 3 months each.

The college undertakes to select industries in accordance with the cooperative agreement. While the students devote all of their time during their industrial periods to their cooperative assignments, they maintain normal connections with the college with all the privileges and responsibilities of students in full standing. They are required to adjust themselves to the daily routine of the firms to which they are assigned and to observe all their rules and regulations. The industries agree to release the students at the end of each cooperative term.

The industrial experience is considered to be of the character of laboratory work. Upon the completion of each industry period the student presents a written report consistent with the policy of the cooperating firm. This written report is submitted to the Director of Industrial Coordination and the contents describe the experiences of the student. A formal rating by the cooperating firm forms the basis for satisfactory completion of the industry period.

The Chairman of the Department of Biological Sciences has a quarterly record of each student majoring in the department. On the basis of this record the work of each student is consistently under review and the field of interest, student membership in scientific and professional organizations, attendance at seminars and scientific meetings, and supervised readings, particularly during the industry period, are encouraged on an individual basis.

Our experience at Drexel indicates the value of the cooperative plan of education and we are finding it readily adaptable to the field of the Biological Sciences.

AAAS New York Meeting

December 26-31, 1960

THE 127TH MEETING of the American Association for the Advancement of Science will include sessions of 18 AAAS sections and of some 88 participating organizations. Programs of particular interest to biologists are:

AAAS General Symposium. Moving Frontiers of Science V: Two of four distinguished addresses will be "Development of Present Concepts of the Organization of the Brain" by H. W. Magoun, Dec. 26, eve., and "The Molecular Basis of Vision" by George Wald, Dec. 28, aft.

AAAS Section C—Chemistry. Two-session symposium, "Mechanism of Action of Antitumor Agents," arranged by C. C. Price, Dec. 27; sessions for contributed papers in organic and medicinal chemistry, Dec. 26.

AAAS Section F—Zoological Sciences. Three-session symposium, "Life under Extreme Conditions," Dec. 27, 28: Part I, Plants and Animals, arranged by C. P. Lyman; Part II, Cells and Tissues, A. Cecil Taylor; Part III, Human Aspects, John P. Marburger. Zoologists' Dinner and vice presidential address by Viktor Hamburger, Dec. 29.

AAAS Sections F and G jointly. Symposium, "Unsolved Problems in Biology 1960: Submicroscopic Cellular Structure and Function," arranged by Karl M. Wilbur and Barry Commoner, Dec. 29.

AAAS Section G—Botanical Sciences. Botanists' Dinner and vice presidential address by Barry Commoner, Dec. 29. Symposium, "Machine Methods in Biology," arranged by David Rogers; sessions for contributed papers, Dec. 30.

AAAS Section I—Psychology. Symposium, "Physiology of Feeding and Drinking Behavior," arranged by Eliot Stellar, Dec. 29, morn., speakers—John Brobeck, A. N. Epstein, Charles Hamilton, Albert Stunkard, Philip Teitelbaum.

AAAS Section N—Medical Sciences. Five-session symposium, "Biophysics of Physiological and Pharmacological Actions," arranged by A. M. Shanes, Dec. 26-28. Chairmen (first) and speakers:

Part. I. Elementary systems (transport models and models for drug interaction)—T. Shedlovsky, J. F. Hoffman, R. L. Post, T. Hoshiko, N. L. Gershfeld;

Part II. Nerve: Structure, electrochemistry, energetics—K. S. Cole, J. David Robertson, W. P. Hurlbut, F. A. Dodge, K. Koketsu, J. M. Ritchie, B. C. Abbott, M. G. Larrabee;

Part III. Muscle I: Electrochemistry, action potentials, excitation—A. Sandow, P. Horowicz, R. Swan, Walter Freygang, Gertrude Falk, C. P. Bianchi, George B. Frank, A. M. Shanes, William G. van der Kloot;

Part IV. Muscle II: Structure and contraction, general energetics—W. O. Fenn, L. D. Peachey, A. Sandow, R. Podolsky, Harry Grundfest;

Part V. Muscle III: Heart fibers, smooth muscle—C. Ladd Prosser, B. F. Hoffman, J. W. Woodbury, S. Winegrad, W. C. Holland, L. Hurwitz, L. Barr.

Carl F. Schmidt will give his vice presidential address, and the sixteenth Theobald Smith Award will be presented, Dec. 27, aft.

Among the twenty-two specialists who will present review papers in the four-session symposium, "The Sciences in Communist China," Dec. 26, 27, are: T. H. Cheng, Pennsylvania State University—Zoology; C. C. Li, University of Pittsburgh—Genetics; H. L. Li, University of Pennsylvania—Botany; and R. W. Philips, U. S. Department of Agriculture—Agriculture.

The symposium will be a joint presentation by the AAAS and the Conference on Scientific Communication. Cosponsors are the National Science Foundation and ten societies, including the AIBS.

SOCIETAL PROGRAMS

Alpha Epsilon Delta. Symposium, "Career Opportunities in Medicine, Dentistry, and Related Health Fields"; annual luncheon and address, Dec. 29.

American Astronautical Society. Sessions include a panel on Bioastronautics, Dec. 27, eve.

American Geophysical Union. The

Continued on page 27

The Director of Biological Abstracts discusses the new facilities available and plans for the future

G. Miles Conrad

Director, Biological Abstracts, University of Pennsylvania, Philadelphia

Biological Abstracts Tools Up for the Future

By February of 1961 *Biological Abstracts* will have published one million abstracts during the thirty-four years since its establishment. So steep is the present rate of primary publication, however, that we can expect that *BA* will publish its second million within the next ten years. Unlike a primary research journal which, to a degree at least, can control and maintain its size by increasingly rigorous editorial selection and subject specialization, a comprehensive research information service such as *Biological Abstracts* must grow in direct proportion to the total volume of research publication. To make sure that the biological community would continue to have an adequate information service despite the explosive growth of primary publication, the Trustees of *Biological Abstracts* in 1956 adopted a plan which would double our coverage of the research literature in ten years and obtain the physical quarters necessary to achieve this goal. It is gratifying to report that in less than five years' time, with continued support of its volunteer abstracters, section editors and subscribers, *Biological Abstracts* has been able not only to double its abstract coverage but also to move into its own completely modernized and expanded quarters.

New building designed for efficiency

On October 6 and 7 a housewarming and symposium on "Biological Communications: Theory, Structure, Function, and Management" marked the formal occupancy of *BA*'s new central editorial office building. The remodelled building retains the same address—3815 Walnut Street, Philadelphia 4, Pennsylvania—but it is double the size of the original. At a cost of about $225,000 for land and buildings, the original building has been completely redesigned and remodelled to suit the special needs of *Biological Abstracts*' work flow. The building is centrally air-conditioned and is served by a new five-story elevator. On the first floor are located the Director's and Business Manager's offices, a Board Room which will double as a small auditorium and general conference room, a reference library, and the major portion of the Literature Acquisition Department. In addition to private offices for department heads and members of the editorial staff on the second, third and fourth floors, special offices or isolated areas are available for such diverse activities as composition, proofreading, page make-up, literature acquisition and recording, bookkeeping and accounting, circulation records, etc. In the completely remodelled basement are a small staff lunch room and kitchenette, a special Addressograph room, and a large area reserved for the installation of automatic data processing equipment.

87,000 abstracts in 1961

As *Biological Abstracts* moves into its new quarters, work is under way on its 1961 volume. This volume will contain some 87,000 abstracts and the work on it has been so planned that by December of 1961 our acquisition and editorial programs will be processing abstracts at the rate of 100,000 per annum. It is believed that a coverage of 100,000 articles per year, while some distance from "complete" coverage of the biological research literature, is an efficient optimum that will leave little of significance untouched. With this belief as a guiding principle, *BA* anticipates that its coverage will hover around 100,000 in 1962 and for several years thereafter.

189% increase in coverage since 1955

In 1955 *Biological Abstracts* published 30,058 abstracts. The publication of 87,000 in 1961 represents an increase of 189% in six years' time! Such an expansion in so short a time in the steel, automotive, or textile industries, for example, would not only be phenomena of widespread effect upon our economy, but would also present a multiplicity of problems to the management of the industries concerned. Whatever the effect of optimum coverage on the "economy" of biology, its effect upon the management of *Biological Abstracts* has been noticeable and immediate. For ex-

ample, the system of recording the receipt of primary journals and abstracts which was adequate for annual receipts of the order of 25,000 to 30,000 items was neither easy to apply to a much larger volume of items nor sensitive enough to keep us on the alert with reference to growing gaps in coverage. As a result, we have installed a modern recording system and equipment that will ensure a more sensitive control of a much larger number of serials and abstracts.

New translation unit in 1961

Although *Biological Abstracts* has always covered the great proportion of the foreign language literature, it must be admitted that a relatively greater proportion of its total coverage has been of articles in the English language. However, as we approach optimum coverage it becomes necessary to improve our coverage of writings in all languages—especially those languages with which so few of us are familiar. To ensure that this will be done, we are establishing a Bureau of Translations. The first concerns of this unit will be with the literature of the USSR and China. However, lest in our great concern with the biological research that is going on behind the "Iron" and "Bamboo" curtains we neglect to assess our coverage of research in other languages and nations, *BA* has been surveying its coverage of the literature coming from other areas of the world. For example, a detailed survey of the Spanish-Portuguese literature has just been completed. At present *BA* abstracts 487 journals in these languages. Our survey uncovered a total of 2942 different biologically related journals published in Spanish and Portuguese. However, after considerable study and search, it was determined that many of these had ceased publication or were of little value from the point-of-view of research reporting. The net result was the identification of 241 additional journals that should be added to the 487 Spanish-Portuguese journals *BA* is already covering.

Exchange with Chemical Abstracts

As the coverage of *Biological Abstracts* grows, it is inevitable that its coverage will impinge upon the coverage of abstracting journals that serve other sciences. To minimize wasteful duplication of effort in abstracting, but to ensure that the biological community can turn to *BA* with assurance that *all* of its interests are covered, we are extending our abstract exchange agreements with such services. For example, *Biological Abstracts* and *Chemical Abstracts* have just signed an agreement which will result in an interchange of 10,000 abstracts per annum. A similar agreement is being negotiated with *Meteorological Abstracts*.

BA's Increasing size frustrating

Up to now we have stressed the increasing size of *BA*. Because it is difficult enough for individuals to review the relatively few primary journals that are regularly available to them, some of them believe our service becomes less valuable as it increases in size. Such a perverse view must stem from the aphorism, "what you don't know won't hurt you." It *is* quite disquieting to realize that the relative handful of primary journals to which one is accustomed does not represent the sum of knowledge about a topic. However, numerous studies of reference citations have repeatedly shown that we are all linguistically and nationalistically biased in our use of the literature. Although this is understandable, it is hardly good scholarship.

Need for detailed, current subject approach

Good scholarship or not, *Biological Abstracts* is realistic enough to know that the sheer bulk of the record makes it a difficult physical and mental chore for an individual to find the small bits of information he needs from the huge morass of (to him) unimportant facts and knowledge that make up even one issue of *BA*. It is our realization of this difficulty, of course, that has led to the subject classified arrangement of abstracts rather than to an alphabetical arrangement by principal author. However, the very act of classification tends to isolate abstracts, for although the principal topic may fall in one category, subsidiary topics or information may relate to many other categories. To minimize this isolating effect of classification, *BA's* editors carefully cross-reference abstracts when necessary. Further, the interdisciplinary nature of newly developing interests in science makes it increasingly difficult to devise a scheme of classification that will satisfy all needs. As a possible solution to this problem, *BA* has for several years provided so-called "subject finder lists" for biochemistry and fisheries biology.

In a sense, however, all of these devices have been resorted to as a kind of interim subject indexing which can be provided concurrently with the published abstracts. Subject indexing, as classically pursued, is a slow and tedious activity. It does not suffice to pick out all the different words that one deems significant and arrange them alphabetically. It is also necessary to probe behind the words to see whether principles or processes, which are not named, are indeed the things which should be indexed rather than the words mentioned. Such probing requires much time and sophistication when one is dealing with technological information. Once the appropriate rubrics have been selected, only part of the classical indexing job has been done. It is now necessary to anticipate, if one can, the way in which some unknown user at some unknown future time will be apt to search for the subject at hand and to so construct the finished index that this unknown person can make effective use of the index. Carefully constructed indexes of this nature are difficult and time-consuming to produce, and it is unlikely that machines can help a great deal in their construction.

Realizing that the ever-expanding literature of biology will create even greater delays in index preparation, however, *BA* for a number of years has been searching for a way of bringing a current subject approach to its contents, pending the preparation of its more elegant regular Subject Indexes. We have sought not for automatic data processing devices, but rather for a system or method of subject indexing which is susceptible to machine handling and which at the same time is efficient economically and in the sub-

ject information it provides. The necessary attributes of the system we have been seeking include 1) a minimum of editorial intervention; 2) adaptability to the printed page; 3) high speed in order to meet a semi-monthly publication schedule; and 4) a reasonably high degree of usefulness to the reader. In some respects these seem to be mutually incompatible requisites and our search has been, until recently, unrewarding.

A relatively new indexing system that seems to meet our requirements is that devised by H. P. Luhn of the IBM Corporation. This system, known as KWIC (Key Word In Context), is a "permuted" word index which arranges the titles of articles alphabetically under each of the words in each of the titles. It is this principle which has been followed by the American Chemical Society in the production of its new publication, *Chemical Titles*.

Semi-monthly BASIC Index proposed

The possible application of this technique to the needs of *Biological Abstracts* and its users has been subjected to a detailed feasibility study which suggests that it meets excellently the attributes noted above as essential to an interim concurrent subject index. It is hoped that *BA* will be able to complete its studies and test runs of this system in time to institute during 1961 this new semi-monthly BASIC Index (Biological Abstracts' Subjects In Context). (*BA*'s "classical" indexes will, of course, continue to be published.)

Customized literature services

Although *Biological Abstracts* will concentrate on the improvement of its usefulness as a widely circulated periodical, there is some indication that customized literature services tailored to the needs of individuals or organizations are very necessary. Because the operation of such specialized services is largely unexplored area, *Biological Abstracts* plans during 1961 to study the potential market for such services.

In conclusion, as the literature of research biology continues to expand, we realize it is not enough merely to abstract and record it. It becomes increasingly vital that *Biological Abstracts* finds way to bring new information quickly, accurately and economically to the biological community. Until now many of our plans for improved information services have necessarily been held in abeyance until we had the space to undertake them. Now that the continued assistance of our volunteer staff and our subscribers in 96 different countries has made possible the acquisition of our new building, they may be assured that *BA* will never slacken in its efforts to give them the best in biological research information services. The central headquarters staff at 3815 Walnut Street is grateful to all of you for your support.

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two-session symposium, "Impact of the Space Program on the Sciences," arranged by Robert Jastrow, Dec. 26, will include papers on molecular biology and the origin of life.

American Physiological Society. Two-session symposium on Space Physiology IV, arranged by Fred A. Hitchcock, Dec. 28.

American Psychiatric Association. Five-session symposium, "Expression of the Emotions in Man," arranged by Peter H. Knapp, Dec. 29, 30.

American Society of Naturalists. National meeting includes two-session symposium, "Modern Problems in Population Biology," arranged by Reed Rollins, Dec. 27, speakers—L. C. Dunn, G. E. Hutchinson, Harlan Lewis, Reed C. Rollins, E. O. Wilson, L. B. Slobodkin, R. H. MacArthur.

American Society of Zoologists. National meeting includes the following symposia and arrangers:

"Physiology of Mollusks," "Evolution of Vertebrate Feeding Mechanisms" (Perry Gilbert), "Evolution of Sex" (Emil Witschi), Dec. 28; "Spermatazoön Motility" (David Bishop), four sessions Dec. 29, 30; "Teaching of Animal Behavior" (E. B. Hale), two sessions Dec. 30. Other events are a panel discussion on "Research Training Facilities" (Wm. Etkin), Dec. 28; the annual business meeting, Dec. 29; Zoologists' Dinner, Dec. 29; and ten or more sessions for contributed papers, Dec. 28-30.

Ecological Society of America. Program includes a two-session symposium and concurrent sessions for contributed papers in plant ecology and in animal ecology, Dec. 26; contributed papers in general ecology and cosponsorship of the ASN symposium, Dec. 27; a second two-session symposium, Dec. 28; and cosponsorship of the two-session symposium on "Teaching of Animal Behavior," Dec. 30.

History of Science Society. The first George Sarton Memorial Lecture will be given by René Dubos, Dec. 27, eve.

Mountain Lake Biological Station. Breakfast meeting of former students, investigators, and staff, Dec. 29.

National Association of Biology Teachers. National meeting, Dec. 26-30.

National Speleological Society. One of two symposia is "Physiological Adaptations of Cave Organisms," arranged by Brother Nicholas, Dec. 27.

New York Academy of Sciences. Three-session conference on Electrobiology, arranged by a committee, Dominick Purpura, chairman, Dec. 30.

Sigma Delta Epsilon. National meeting, Dec. 27-29.

Society for the Study of Evolution. National meeting includes the following sessions: Phylogenetic Aspects of Evolution, Genetic Aspects of Evolution, Dec. 28; general session with presidential address of Alfred E. Emerson, "Vestigial Characters of Termites and the Processes of Regressive Evolution," and invitational address by H. J. Muller, "Reproductive Substitution as a Method of Voluntary Human Evolution Preferable to Differential Birth or Death Rates," Dec. 29, morn.; concurrently, Speciation and Variation, and Ecological Aspects and Methods, Dec. 29, aft.

Society of Systematic Zoology. National meeting includes contributed papers and symposium, "Famous Zoologists," Dec. 27; business meeting, Dec. 28; panel on nomenclature and field trip, Dec. 29.

Society of the Sigma Xi. Sixty-first annual convention, joint luncheon with RESA, and joint address with Phi Beta Kappa, by Polykarp Kusch, Dec. 29.

Torrey Botanical Club. Two-session symposium, "Fundamental Developments in Plant Growth," arranged by Annette Hervey, and luncheon with Wm. Steere, speaker, Dec. 27.

The AAAS Exposition of Science and Industry, with two **AIBS** exhibits, and the **AAAS Science Theatre,** with recent foreign and domestic films, will be prominent features of the meeting. Coupons for sleeping accommodations and advance registration can be found in *Science*.

From the university laboratory comes a morality play in one act with an epilogue

Paul R. Gross

Department of Biology, New York University, New York City

In Plato's Grove

Cast of Characters (in order of their appearance):

Miss Lee. *Assistant to Dr. Xanthias. She is also his wife.*
Wincklemann. *A* diener *in the Department of Biology.*
The Frogs.
Xanthias. *Associate Professor of Biology at Midlands University.*
Diecke. *Graduate student, apprenticed to Xanthias.*
Miss Butz. *Freshman student in biology.*
Mrs. Innerman. *Graduate student.*
Prinz. *Graduate student.*
Freddy Leighton. *Visiting lecturer in chemistry.*
Powell Power. *Book salesman, editor, quondam publicist.*
(Students, Telephones)

Scene One

The office of Professor Xanthias. A large, pleasant room, so filled with papers, books, and hardware that any order is apparent only to Xanthias himself. Papers are everywhere; on tables, spilling out of file-drawers, piled high upon the two desks. Books fill the many shelves, lie open on tables and atop the stacks of examination booklets, lab reports, and dissertations. Down the center of the room runs what was once a chemical bench. It serves now merely as a surface, upon which are disposed a lettering set, a drawing board, a roll of vellum and some sheets of graph paper, a conductivity cell and a Wheatstone bridge, a disassembled cathode-ray oscillograph, a small colorimeter, a rat guillotine, seventeen bottles of wet and dry reagents, three reams of duplicator paper, photographic chemicals in yellow cans, a microscope in its case, parts of an unsuccessful Xanthias-designed micromanipulator, a 35 mm camera, boxes of outdated sheet film, an ancient pH meter in its mahogany case, and a bottle of well-cooked, but inexpensive sherry. Austere and elegant, the finely-machined rotor of a new ultracentrifuge sits alone on the shelf.

At right, a large desk, with an old typewriter and a new dictating machine. Two filing cabinets alongside, and atop these many dusty lantern slides. The desk chair is one of the small posture-improving devices made for bottomless stenographers. At left, a metal-and-glass partition with an open door encloses the smaller desk, this one buried under papers. The partition is eight feet high and is supposed to provide privacy, but it serves only to hinder communications across the room. Many chairs and stools scattered about. At right, a door opens from the corridor. On its frosted pane one can just make out "SAIHTNAX .FORP".

At curtain, the room is empty. It is about ten in the morning of a wistful Autumn day. Several large windows provide glimpses of cerulean sky and the limbs of maples, their reluctant leaves now rose and gold. The stillness is disturbed only by the muffled whine of a shaking machine on a table at far left, upon which two Erlenmeyer flasks oscillate with their bile-green contents. A telephone is on each desk. The stage is empty for three minutes, but during this interval, each 'phone rings once. The sound is insistent and unlike the moan of doves.

Miss Lee enters. She is a tall, well-designed woman of about thirty. Her step is firm and rubber-cushioned. She wears a white labcoat. Carrying two Erlenmeyer flasks, she goes directly to the shaking machine and affixes them. The telephone on the larger desk rings.

Miss Lee *(going to desk and answering):* Hello. Yes, this is Dr. Xanthias's office. No, he's still in class. In a few minutes, I should imagine. Do you have an appointment? Would you call back then, please? I'm not sure of his schedule for this afternoon. Thank you. Goodbye.

Wincklemann *(enters, carrying a large, wet carton):* Good morning, good morning, good morning! Look what I've got!

Miss Lee: Good morning, Frank. What DO you have?

Wincklemann: Frogs. From Wisconsin. Came Air Express.

Miss Lee: Oh? Good. Why don't you just put them in the tank?

Wincklemann: Dr. Xanthias said not to put any more frogs in the tank until he cleans it out some special way because it's got red-leg or something. Where should I put these?

Miss Lee: I don't know. *(A pause. She looks around. No table space.)* Here; put them on the floor in this corner. I'll ask Dr. Xanthias what he wants to do with them when he comes in.

The Frogs: Brekekekex, coax, coax.

Miss Lee: Thank you, Frank.

Wincklemann: Don't mention it, Mrs. Xanthias. *(Exits.)*

(The telephone on the small desk rings. Miss Lee goes to it and answers.)

Miss Lee: Hello, Dr. Xanthias's off—Oh, hello, Dean Mesmer. Fine, thank you. No, he's still in class. Yes, of course. What committee is that? Wait just a moment, please, while I look in his appointment book. *(Flips pages in a memo book on the desk top.)* Here it is. Yes. "Integrative Committee on Policy, Planning, and Procedures in Research Management". *(Pause.)* Oh, well, because he wrote it all down and then outlined it in purple ink with arabesques and acanthus leaves. Yes . . . Three this afternoon. I'll remind him. Surely. Goodbye, Mr. Dean.

(Mammalian noises are heard in the corridor—voices of undergraduates. Xanthias enters, followed by several students assorted in size, dress, and sex. Xanthias is a tall man, of good physique but poor posture, about thirty-five, and looks simultaneously enthusiastic and harassed, owing to the peculiar conditions of his life. He wears a brown tweed suit and carries in one hand a fat briefcase taken home the previous evening and returned, unopened, this morning; in the other hand, a number of letters. Becoming aware of his pursuit, he turns back to face the philomatheans.)

Student: What about it, Doc? Are we going to be held responsible for those formulas?

(Murmurs of agreement with the inquiry's urgency.)

Xanthias: First of all, there's no need to be so formal. A simple "professor" will do. As to your question: you are responsible only for what is important.

(Murmurs of dissatisfaction.)

Student: But look: for instance, do we have to know the formula for glucose—that way you drew it?

Xanthias: Yea.

Another Student: How about all those amino acids?

(Xanthias pauses, puts down the briefcase, and stuffs the letters into his pocket. Miss Lee, silently, picks up the briefcase and carries it to Xanthias's desk.)

Xanthias: Look here, do you delinquents want me to give you a copy of the exam?

Students *(Gaily.)*: Yes!

Xanthias *(Waving his arms)*: Out, all of you! Out before my blood boils, or my nostrils spew flames! Out! This is biology, not social dancing! Very soon now, you will discover what you must know for the exam.

Students: When?

Xanthias: Tuesday morning, at the exam!

(Students exit with cries of dismay. Xanthias closes door quietly while Miss Lee slips the letters unobtrusively out of his pocket and goes to her desk. Xanthias fishes in the opposite pocket for a pipe, finds it, and lights up as he goes to his desk. The pipe goes out at once, having been smoked before. He flings it away onto the desk top, broadcasting ashes.)

Miss Lee *(perusing letters)*: What an Educator.

Xanthias: Poppycock, my girl. Any calls?

Miss Lee: A student. Wouldn't leave her name. Will call back. Powell Power, from Scholastic Publishers, stopped in. I told him you were off to New Caledonia for the day, but he said he'd stop back this afternoon. *(Xanthias groans.)* Bill Mesmer to remind you about the meeting at three.

Xanthias: Oh, yes, the PeePee committee—

Miss Lee: —Wincklemann left a box of frogs *(pointing)*.

The Frogs: Brekekekex.

Xanthias: Why didn't he put them in the tank?

Miss Lee: Because you said it has redleg.

Xanthias: Oh. That's right. Let's put them in a big tray in the refrigerator until we can clean up the tank.

Miss Lee: O.K. Now?

Xanthias: No. Wait a minute. Did my centrifuge tubes come?

Miss Lee: No. I checked. The order hasn't been placed yet.

Xanthias *(enraged)*: What? We put it in two weeks ago!

Miss Lee: Ten days ago.

Xanthias *(subsiding)*: Oh well. Anyway, we HAVE to perfuse those rats today. If we don't get the liver fractions by tonight, all of last week's experiments will be wasted. The samples have been in the refrigerator for four days. Anyone in the lab yet?

Miss Lee: No. They're probably all with Lackhead, coaching him for his oral exam tomorrow.

(Xanthias removes his suitcoat and puts on a white labcoat. He fills another pipe with tobacco and lights it.)

Xanthias: They're no damned help anyway. Let's take a quick look at the mail and then go down to the lab.

Miss Lee *(going to her desk)*: An inquiry from Dean Pomp about a student on probation, a Mr. Karp. An inquiry from the Dean of Women about a Miss . . .

Xanthias: —Goldfish.

Miss Lee: —Eagle. General Strife wants to know whether you've written to the drug companies about a subsidy for the Memorial Volume. Professor Updon wants three preliminary exam questions for a Mr. Harvey, in Physiology. An oral exam tomorrow for—

Xanthias: —a Mr. Vesalius, in Anatomy—

Miss Lee: —Mr. Lackhead, and you'd better be there; he's *yours* and needs protection. Your manuscript came back from the J.P.B. by certified mail. Parker says to read the enclosed comments by the referees and make changes. They seem to want you to do the experiments all over again. A lot of second class stuff—I put it on your desk.

(Xanthias settles glumly into his chair.)

The Frogs: Brekekekex.

Xanthias: Those damned frogs! Here, let's take them out and—*(the telephone rings)*

Miss Lee *(answering):* Hello. Yes. Who is calling, please? Oh, yes, Dr. Clapper. Just a moment. *(She holds the telephone for Xanthias.)*

Xanthias *(at phone):* Yes sir. Wednesday? I don't know, but let me look. *(To Miss Lee, quietly:)* we doing anything Wednesday night? *(she shrugs, then signifies "no".)* No, sir. What? High school teachers? Are you sure you want ME? *(Long silence . . . jabbering from the receiver)* Yes. Sure, I'll be glad to. Six o'clock at the University Club. Righto. Goodbye. *(hangs up.)* Our intermediate vice-president is doing a bit of public relations on Wednesday night. I'm to be one of the exhibits. They'll pay for this!

Miss Lee: How?

Xanthias: I'll drink all the liquor.

Miss Lee: Then you'd better plan to give me your car and come home by train.

Xanthias: Says you, sister.

Miss Lee *(taking no notice):* Wagner left his thesis for you to read—

Xanthias: —Philosophie, Juristerei und Medizin, und—

Miss Lee: —I'm supposed to remind you to read it right away, because you haven't seen the data yet, and somebody else is doing the same thing—

Xanthias: —yes, yes. Too late. They've done it. And much better than did Wagner. Let's go down to the bleeding laboratory.

The Frogs: Brekekekex.

Xanthias: Oh, bother bother bother! *(Goes to the wet carton, lifts it, and carries it out.)*

(Miss Lee dials a three-digit number and lifts the receiver.)

Miss Lee: Frank? Oh. May I speak to Mr. Winckelmann, please? *(Pause.)* Frank? Yes. Would you bring up the three rats in the yellow-marked cages, please? Yes, to Dr. Xanthias's lab. Thank you. In a short while, I hope, otherwise heads will roll. Okay, Frank. Goodbye.

(Enter Diecke, a thin graduate student, sinful and perturbed.)

Diecke: Hello, Mrs. Xanthias. Is Dr. Xanthias in?

Miss Lee: Yes. He's putting some frogs away . . . in storage, that is. Can I help you?

Diecke: Well, no. I, I think I'd better wait for him. Is he in a good mood this morning?

Miss Lee: Certainly. Why do you ask?

Diecke: The spectrophotometer is broken again.

Miss Lee: Can't you fix it?

Diecke: I'd better not even try. The last time, I broke it worse.

Miss Lee: Well sit down. You might just as well suffer on a perch.

Diecke *(remains standing, almost wringing his hands, trying to think of sugar plums):* I'd better just wait here—

(Xanthias enters, drying his hands on a towel.)

Xanthias: Okay! Now we call Frank and get—*(sees Diecke)*—hello, Slim. What's on your mind?

Diecke *(agonizing):* The Beckman's broken again. I don't know what's happened. I just came in and turned it on and put in the sample after the warmup and the needle's 'way over and won't zero or move.

Xanthias: All right. Relax. Let's go and have a look at it. *(Xanthias and Diecke exit.)*

(Miss Lee goes to her desk and begins to arrange papers in trays. She files some in the cabinets, others in the wastebasket. The telephone rings.)

Miss Lee *(answering):* Hello. Hi, Ruth. All set. Yes, I've got Mr. Fraulich, from Couture Associates, to come for the February meeting. He's bringing models too. Yes, they'll love it, even if none of us can afford to buy his stuff. *(Pause.)* Sure thing, kitten, only you'd better sign off. I'll call you from home later. Father Time is having a bad morning and he'll bellow like a wounded animal if he—*(Xanthias enters)* catches us. So long.

Xanthias *(as Miss Lee hangs up):* Now who in Byzantium was THAT, Miss Lee?

Miss Lee: Women's Faculty Club business.

Xanthias: Decrepit hags.

Miss Lee: Come, come, let's not despond, not think negatively.

Xanthias: Look, Suzuki, I think around here any way I want to.

Miss Lee: What's wrong with the Beckman? Is there anything we can—

Xanthias *(voice raised in anger):* Nothing; That fearful cretin was using the tungsten lamp and trying to read in the ultraviolet.

Miss Lee: Is that bad?

Xanthias: It's not good. *(Sits at desk.)* Now, let's answer Daddy Warbucks's letter and get down to the lab.

Miss Lee: How about Updon's prelim questions?

Xanthias: You make them up. My brain is desiccated.

(A discreet knock on the door. Miss Lee opens it and a female undergraduate of excellent and generous proportions enters. She is very fashionably dressed, wears gloves, and carries a ruffled polka-dot umbrella. Her name is Miss Butz.)

Miss Butz: Excuse me, could I see Dr. Xanthias?

Miss Lee: Have you an appointment?

Miss Butz *(her eyes cast daggers):* Are you his secretary?

Miss Lee: In a manner of speaking. Does he expect you?

Miss Butz: No, but I just want to talk to him for a second. It's about the exam in bio one-two. It's very important.

Miss Lee: Well, now—

Xanthias *(from the cubicle):* Come in, Miss Butz, come in. What troubles your maidenly mind? Miss Lee, please call the animal house about our maiden rats.

Miss Lee *(resigned):* I did. *(She goes to her desk and continues to sort papers, rubber-stamping some with unaccustomed vigor.)*

Miss Butz *(going to the chair which Xanthias has pulled up next to his desk. She opens her Wedgewood eyes and speaks with exaggerated precision, for she has diagnosed Xanthias's illnesses as related to meticulous speech.):* Professor Xanthias, I just have no idea about what to do regarding the exam in bio.

Xanthias: You don't?

Miss Butz: No. I thought this was supposed to be a biology course, and since I'm not a science major, being interested in soc and eco, and now you're giving all this chemistry and I just don't have the background?

Xanthias: But you do, Miss Butz, you do!

Miss Butz *(exhausted):* I do?

Xanthias: Did you study chemistry in high school?

Miss Butz: Yes.

Xanthias: I know you did. Did you study biology?

Miss Butz: Yes, but it wasn't—

Xanthias: —and English?

Miss Butz: Yes?

Xanthias: You also wrote a College Entrance Examination?

Miss Butz: Yes.

Xanthias: And surely you achieved an acceptable score, Miss Butz. Else I should not have had this pleasure. Then you have precisely the background for which I prepare my lectures. Now what specifically is your problem?

Miss Butz *(draws closer and gazes with sincerity at the tormentor, adjusting, meanwhile, the fit of her lumbar parts to the oaken chair):* I just can't understand or remember those formulas. You go so fast, and I don't understand all that stuff with regard to water why it's such a special liquid or—

Xanthias: That doesn't sound at all serious, Miss Butz. I'm sure that your little difficulty can easily be cleared up. I'll arrange for your conference section instructor to go over it with you in detail. *(Rising and addressing Miss Lee.)* Miss Lee! Call Mr. Diecke and ask him to pay particular attention to Miss Butz's questions at tomorrow's conference. He can check with me about it later.

Miss Lee *(from almost inside a filing cabinet):* Yes, sir.

(Miss Butz, leaving her gloves on the desk, rises uncertainly.)

Xanthias: Good morning, my dear. I'm convinced that you will do very well.

(Miss Butz murmurs "thanks" and exits. Xanthias goes to his own file and extracts a dossier. He sits at the desk and sees the gloves.)

Xanthias: Damn!

Miss Lee: You called me?

Xanthias: She left her gloves.

Miss Lee: Naturally.

Xanthias: I beg your pardon? Here, take them out to the report table in the corridor. I'll be out when she comes back for them.

Miss Lee: Too bad.

Xanthias: Too bad what?

Miss Lee: You're not a glove-fetishist. *(She takes gloves and goes out.)*

Xanthias *(glumly):* Don't count on it. *(as Miss Lee returns)* What time is it!

Miss Lee *(consulting wristwatch):* Eleven-thirty.

Xanthias *(resigned):* Okay, I give up. You've got to leave soon. Too late to do the experiment this morning I'll get Prinz or Dave to help me this afternoon . . . after the committee *schauspiel.* Let's do the letters.

Miss Lee: Right. But first give me some money, before I forget. We have a piano lesson this afternoon, and I have a dollar.

Xanthias: Money? *(digs in his pocket, fishing out a bill and some change.)* Who has money? I have a dollar . . . fifty . . . seven.

Miss Lee: Is that all?

Xanthias: You seem surprised, lass. When do I ever have more? You'd better cash a check at the bookstore on your way out and leave some money for *me* at the office, otherwise I must fast or walk home. We need gas in the car.

Miss Lee: I'm not sure about the balance . . . it's the end of the month.

Xanthias *(expansively):* Let the bankers worry, my pet! The letters!

Miss Lee: Yes. *(She brings a trayful of letters and a notepad, sits in the Butz-vacated chair.)* We'll do as many as we can now . . . Let's try to do the prelim questions too. You can dictate the rest later and I'll take them from the machine tomorrow morning.

Xanthias: Ave.

Miss Lee: Come on, I've got to be home on time today.

Xanthias: Atque vale. "My darling General Strife."

Miss Lee *(repeating):* "My darling General—"

Xanthias: "Since I have nothing better to do than sit around here and indite missiles—"

Miss Lee: "Indict missiles"?

Xanthias: No, no, Miss Lee. Now in earnest: "Dear General: Thank you for your note of—"

The curtain falls and remains lowered for a few minutes to denote the passage of several hours.

Scene Two

The same place. It is now about four-thirty in the afternoon. The sunlight outside has turned flaming ochre; fluorescent overhead lights have been turned on. A chill wind stirs the treetops outside the windows and leaves flutter past like wounded birds. At Miss Lee's desk sits Mrs. Innerman, operating a desk calculator and making entries in a notebook. A tall, pitted graduate student, Prinz, in a white labcoat, is examining the bookshelves, searching for a volume containing pictures suitable for the amusement of his infant son.

Mrs. Innerman: Whatever you're looking for, Oliver, you'd better get it and scram. Xanthias was looking for you all day. You promised to come in and help him do an experiment. He never did get to do it, and it's four days overdue. Miss Lustre finally told him that you don't get here until three these days. Besides, you know how he hates to have people borrow his books, even when they're overdue from the library.

Prinz *(unconcerned):* The bug bit him again today?

Mrs. I. *(finishing an entry):* Something bit him. He cut me dead when I came in and started to use the calculator. I guess he's just not a predictable man. Then he smoked off to a meeting. You know what he's like when he gets back from those meetings. Just petulant.

Prinz *(standing on a chair, lofty):* What he lacks in brains he makes up in steam, that's all.

Mrs. I.: Oliver!

Prinz: Relax, kid. Just being objective.

Mrs. I.: By the time he was your age, he'd done more than you'll ever do.

Prinz: Thanks for the compliment. We'll see about that. *(Exits bearing books.)*

(Mrs. Innerman operates the machine for a minute. Then Freddy Leighton enters. He is a robust Englishman of twenty-nine, who looks as though his clothes had been slept in by another, smaller, Englishman, for some months. Otherwise he is clean, ruddy, and cheerful, and wears a pair of ridiculously small-lensed spectacles. He is a visiting lecturer in theoretical chemistry. A chessboard and chessmen are the objects he carries.)

Freddy: Ah! Mrs. Innerman, celebrated in song and story! You are no less beautiful today than at other times. Hello hello hello.

Mrs. I.: Hello, Dr. Leighton.

Freddy: Is your, shall we say, boss, in?

Mrs. I.: Not yet, but he's expected momentarily. He's at a meeting.

(Xanthias enters, looking tired. He flings his black hat onto the chemical bench, toppling several reagent bottles.)

Freddy: Hail, servant of Dionysus.

Xanthias: Hail, Schmail. What do you want, you renegade *sahib?*

Freddy: My revenge, old man, my revenge. I won't be put off again. Mate in twenty. Morphy Leighton to the attack!

Xanthias: Listen, boy, you have nothing to do all day but balance on your posterior and doodle . . . wasting your department's paper, at that. I, not being sufficiently smart to be a theoretiker, must earn a living by doing experiments; WHICH YOU AND YOUR KIND ARE TRYING AT ALL COST TO PREVENT!

Freddy: I say, steady on!

Xanthias: Don't take that personally. I'm practising for an interview with the purchasing agent. But I really can't play chess here. Someone might catch us and cut my salary. Also, I do have some little rat livers to perfuse, and I yearn to wrest secrets from nature's bosom. Why don't you just sample that sherry over on the bench and begone? *(To Mrs. Innerman):* Has Dave shown up?

Mrs. I.: No. He's supposed to be somewhere in the main library, studying for Updon's exam in library technique.

Freddy: Is it really off, Dion?

Xanthias: Yes, Freddy. For today. And tomorrow. But I do promise to let you win on Sunday, provided that you bring Sybil for me to admire while you're doing it.

Freddy: I say, steady on, man! *(Exits, disconsolate.)*

Xanthias: Mrs. Innerman, would you, perhaps, have some time to—

Mrs. I.:—I'm just finishing these statistics, Dr. Xanthias, and then I have to go home. My housekeeper leaves early today and there won't be anyone with the children.

Xanthias: Right-o. *(Goes to his desk.)*

(Miss Butz enters without knocking and goes to Xanthias.)

Miss Butz: Doctor Xanthias!

Xanthias *(startled):* What? Oh. Miss Butz. Can I be of service?

Miss Butz *(charmed):* You see, I'm trying out for THE PENGUIN. They don't usually take freshmen this soon in the year, but I think I have a very good chance.

Xanthias: I'm sure you do too.

Miss Butz: You're going to be on that panel about Bertrand Russell next Thursday, Dr. Xanthias, and the other members have already given us their statements.

Xanthias: Statements?

Miss Butz: Yes; Dr. Grübler, from History, Dr. Pisch, from Soc, and Dr. Stretcher, from Phil. They've all given us a short statement about their ideas about Russell's impact on their field. Now we'd like to have your idea, as a scientist, to sort of fill things out.

Xanthias: I see. Now look here, Miss Butz, this is all highly—

(Powell Power, college text editor at Scholastic Publishers, Inc., enters without knocking and goes directly to Xanthias's desk.)

Power: —Hello, Sir. Powell Power, Scholastic Publishers. *(Hand outstretched.)*

Xanthias *(taking proferred hand, bewildered):* —Oh, hello, Mr. Power. I'll be with you in just a minute.

Power: Oh, don't take any trouble. I've got to leave in a minute anyway; just stopped to ask if you could join some of us later, for dinner.

Xanthias: Oh, the text-authors' grab-bag?

Power: Right. Very cute. How did you know?

Xanthias: Clausius invited me. But I can't go. Besides, if you bookhounds don't leave me alone, I'll never get anything written.

Power *(Laughing):* All those luncheons, eh! Well, it'll be a hot manuscript, Doctor. By the way, your secretary, Miss Lee is it? . . . She's quite a gal.

Miss Butz: Dr. Xanthias, I—

Xanthias: Miss Butz, if you'll step over and talk to Mrs. Innerman there for a minute, I'll finish with this gentleman and then we'll get you your statement. *(Miss Butz, almost, but not quite curtseying, withdraws to engage Mrs. Innerman in desultory conversation. Xanthias then turns to Power.)* Power, old tool, we don't broadcast this before undergraduates for various reasons, but that there gal, Miss Lee, is my wife. First one, too, and mother of my children.

Power *(all good humor):* Well that's fine, Doctor. Congratulations. How do you manage it? Those poor people over in the humanities have essentially no secretarial help at all. This school must discriminate against them.

Xanthias: Miss Lee is not an employee of the university. She works for me, and the U. S. government pays her salary, through my research grants. Furthermore, she's not a secretary. I couldn't afford to hire a real full-time secretary, even if it were legal, which it is not. Miss Lee is a scientist, and my research assistant; you see her in this godforsaken office because I'M godforsaken and here today instead of downstairs in the lab—

Power: I feel for you, Doctor, I feel for you. Sure you can't make it for dinner?

Xanthias: No, but thank you for the invitation. I haven't seen my kids for three days, and Im going home today for dinner if it . . . *(suddenly)* . . . by God! No I'm not! I'll have to stay and do that perfusion experiment—

Power *(not paying attention):* Well okay, Doctor. Before I go I'm just going to leave a few pieces of literature on your table here. Okay?

Xanthias: Go ahead, if you must.

(Wincklemann enters, bearing a large, wet carton.)

Wincklemann: More frogs, Doc! Shipment was in two packages. These've been over by the radiator in the postoffice all day.

The Frogs *(weakly):* Brekekex.

Xanthias: Wait a minute, Frank—

(Through the thin wall, from the laboratory classroom adjoining Xanthias's office, arises a sound as of a stampede. The class in biology has been dismissed. Voices begin to fill the corridor; laughter, screams, snatches of song: above all, on a rising note of frustration, the voice of Prinz, pleading, threatening. Miss Butz has, meanwhile, decided to remove her coat. Mrs. Innerman, who has finished her calculations, is doubtful about leaving, and Power is skillfully and intelligently depositing catalogues at various points about the room. Diecke enters, forlorn.)

Diecke: Dr. Xanthias.

Xanthias: —Just a moment, Frank. Yes, what is it, Mr. Diecke?

Diecke: The pH meter. The new one. It's broken. *(Brokenly:)* The needle won't zero.

Xanthias *(raising his voice, to be heard over the din):* It's not supposed to zero!

(Diecke remains, guilt-ridden awaiting clarification of this cryptology.)

Wincklemann *(discreetly):* The frogs, Dr. Xanthias.

The Frogs *(expiring):* Breke.

Xanthias: Great Gods of Olympus! Call down a plague on all—

(A great thud from next door signals the angry lowering of the sliding blackboard by Prinz. Miss Butz, taking the bull by the horns, approaches Xanthias with elastic step.)

Miss Butz: Dr. Xanthias, perhaps we can—

Xanthias: —No we can't, darling. Go away, but don't take it personally. You can see that it's impossible right now. I'll write something for THE PENGUIN tonight, and then—

Miss Butz: —oh, and do you want me to come in and—

Xanthias: —yes, pick it up at the departmental office tomorrow. Good night, Miss Butz. *(She goes slowly to get her coat and exits.)* Frank!

Wincklemann: Sir?

Xanthias: Take that carton of frogs and stuff it into the refrigerator. *(Wincklemann remains, however, awaiting clarification. The din in the corridor grows. Xanthias goes to the telephone and dials a four-digit number.)* Hello. Freddie? Freddie, let's go to Mosotti's for dinner tonight. We'll play chess. About six. No, I've got to remain and do something in the lab. *(Pause.)* No, I'll explain later. You must be tolerant of me, as I may be approaching my final hour . . . I seem to hear frogs all the time—

The Frogs: Brek.

Xanthias: Yes. Good. No! To hell with helices; Bring the pocket chessboard. *(Pause.)* By all means, bring Sybil. Oh, I see. No chess then. We'll talk about playwrights, and I'll tell dirty stories . . . you can recite limericks. Quite. What story is that? No, I haven't heard it—*(While Xanthias listens, the thunder in the corridor grows in volume. It has now reached ninety decibels. Wicklemann stands and waits, shifting his weight from one foot to the other. Diecke appears ready to be flogged 'round the fleet. Mrs. Innerman, whose husband is a surgeon, argues volubly with Power about medical books and journals, although Power, who is quick, is having the best of it. The other telephone rings.)* —Freddie, sorry to interrupt, but the other telephone is ringing. Save it for later. Thanks. *(Goes to the other telephone and plugs his left ear with a finger in order to hear with the right. Involuntarily he shouts.)* Hello hello! Dean Mesmer? Fine! How are YOU sir? TOMORROW? I don't know. Can I call you back later? Oh, you're going home. Well, hold on a moment, please . . . *(rushes to the appointment book, and begins frantically to turn pages.)* Yes, I have it now. There are some doctoral oral exams scheduled—

(Prinz enters, rushes to Xanthias with fire in his eyes.)

Prinz: Doctor Xanthias! Those freshmen are a pack of wild animals! I just can't control—

(At this point, the class bell rings noisily. All over the building, classes are being dismissed and the noise rises to a noble crescendo as the curtain quickly falls.)

Epilogue

The inaction takes place in the study of Xanthias's house, located in a respectable but not affluent suburb about ten miles from the university. Many hours have passed since the cataclysms of the afternoon; it is after ten P.M. The study is an ungracious oblong room which served in its days of vigor as an "enclosed porch." The structural ugliness is mitigated, to a degree, by the comfort of the furnishings, which represent neither plan nor period, but rather the acquisitions of a man free to seek comfort by all means other than the expenditure of money. There are many books, quite as many, in fact, as at the office in the university. The hardware is, however, somewhat different: sound system components, some built quietly in the university electronics shop, an experimental, and hence unfinished, speaker enclosure, a tripod and an imitation leather bag crammed with photographic equipment, pipes and tobacco, phonograph records, a small telescope. A few watercolors by artists known only to Xanthias hang on the walls, and a large and handsome typewriter, rented, stands on a great old desk. A folded projection screen stands in one corner, next to a cased slide projector. The large gold-colored sofa, spotted, and retired by Mrs. Xanthias from formal service, dominates the rear wall; a few cast-off but comfortable chairs stand about. Again, many papers. One bookcase contains books with

interesting bindings. Another, very much the larger, is stuffed to its elastic limit with scientific books, many in the tasteless dust jackets so dear to text publishers. Xanthias has purchased a small number of these, but the rest are on loan from the library or are gifts of the publishers.

At curtain, Xanthias enters through the door at right (another door is at left). He carries the overstuffed briefcase to the desk and places it next to the pedestal. He looks a bit weary and manfully smothers a yawn. Choosing a pipe from the rack on the desk, he fills and lights it, and then sits on the sofa to loosen the laces of his shoes. Mrs. Xanthias enters left. She wears a soft dressing-gown of intermediate length, mules with large pom-poms on her feet, and a mob-cap over her hair, which has just been "set." All is in pale blue, and the effect is charming and provocative. She appears warm, recently bathed, and well cared-for. Xanthias is not unappreciative of the effort this represents.

Mrs. Xanthias: It IS you. I thought I'd heard you come in.

Xanthias: Hello, Dulcinea. How are your daughters?

Mrs. Xanthias: Fine. They made drawings on the blackboard and left them for you to see when you came home. You're very late. Did you finish the experiment?

Xanthias *(grimly):* Later, my pet, later. First make us some coffee.

Mrs. Xanthias: I did. It's been ready for over an hour.

Xanthias: Oh. You didn't want to be interrupted while watching the agony on television.

Mrs. Xanthias: Don't be rude. Are you hungry? I bought some nice things this afternoon.

Xanthias: No, but thank you.

(Mrs. Xanthias exits. He, meanwhile, goes to the desk, opens the briefcase, and extracts some papers. He sits and begins to scan and mark these. Mrs. Xanthias returns, carrying a tray on which are a cup of coffee and a coffee pot, an apple, and some foil-wrapped segments of cheese.)

Mrs. Xanthias: You look tired. You ought to come to bed early.

Xanthias: I'm fine, really just blooming. Coffee will rejuvenate the tissues like a shot. Besides, I have a lecture in the morning. Have to look up a few things.

Mrs. Xanthias: You've been giving it for four years now. Do you have to prepare it all over again?

Xanthias *(drawing himself up):* I've given it four different ways. I never give the same lecture twice, even to undergraduates!

Mrs. Xanthias: Why not?

Xanthias *(sipping coffee):* Oh hell, I don't really know. Doesn't seem sporting somehow, when there's so much happening.

Mrs. Xanthias: How about the experiment?

Xanthias: No good. I did it after dinner, alone. Went fine, too, holding the cannula with one hand while cutting with the other. But when I'd finally gotten the livers out, ready for homogenization, I found all the medium you made was gone. It had been in that flask in the refrigerator. Maybe somebody thought it was distilled water and used it to make tea. I hope so. Serve him right. Anyway, I lost twenty minutes making more, and by that time, even on ice, the stuff had gone to pot. Those fractions have to come out right away or not at all. Anyway, our problem is solved. We can now throw out all the stuff from last week and start over again. Tomorrow.

—Maybe. What I want to know now is, against whom, or what, do I . . . like Montaigne's gouty old buzzard . . . exhaust my fearful rage?

Mrs. Xanthias: You've plenty of choice. Come up to bed and we can discuss it.

Xanthias: I can't just now. But I won't be long. Just look over the notes and a few papers—

Mrs. Xanthias: —All right. Good night. *(Goes to door, but halts there and turns to Xanthias.)* And for heaven's sake, don't fall asleep down here and come staggering upstairs in the middle of the night!

Xanthias: Gods on Olympus! What a beastly evil tongue you have, woman. I should beat you soundly with a rod as thick as my thumb!

Mrs. Xanthias: You'll have to make an appointment. *(Grand Exit)*

(Xanthias sits at the desk and relights his pipe. He arranges a number of papers and begins to read and make notes. Going to the large bookcase, he takes down a book, turning to a marked page enroute to the desk. Sits and works again. But after a few minutes, he leans back and rubs his eyes. A yawn is this time unstifled . . . prolonged, in fact, with pleasure. Abruptly, he closes the tome and goes to the radio, turns it on, and listens. When the music comes on, he adjusts the volume downward almost to a whisper. He exits, then, left, and for a moment the stage is empty, but almost at once Xanthias returns bearing triumphantly a bottle and a graceful small wineglass. This sherry is no upstart; some of its limpid drops were there when the solera *began. The music, a Handel recorded sonata, is barely audible. Xanthias sips the sherry, goes to the sofa, and puts his feet up on one arm, his head down on the other. Thus does a five-foot sofa become a contour chair.)*

Mrs. Xanthias *(distant offstage, sweetly):* Dion, please don't fall asleep!

Xanthias *(sits up):* I won't, love. *(Reclines at once.)* Be up soon.

(Indolently, a faint smile on his face, he reaches backward to the small bookcase containing the well-bound volumes: lifting the glass from its place on the floor beside him, Xanthias sips and leafs through a little book bound in green morocco, taken at random from the shelf. He smiles, puts down the glass, and reads quietly aloud:)

". . . Unpin that spangled breast-plate, which you wear,
That th' eyes of busy fools may be stopp'd there.
Unlace yourself, for that harmonious chime
Tells me from you that now it is bed-time . . ."

(He closes first the book, and then his eyes. In a minute, he sleeps quietly, while the earth whirls away on its ancient journey. The greenshaded desk lamp casts a balefull glare upon the inviolate papers.)

Curtain

THE EDITOR'S DESK

The American Society for Cell Biology was formed after two preliminary meetings during 1960. Membership is expected to include biochemists, biophysicists, cytologists, histologists, microbiologists, physiologists, and others having in common an interest in the cell. Anyone having educational or research experience in this area should request information from Montrose J. Moses, Box 2982, Duke University School of Medicine, Durham, N. C.

The Cell Culture Collection Coordinating Committee, under the Chairmanship of Jerome T. Syverton, and under the auspices of the National Cancer Institute, has been established to consider problems developing in the rapidly growing field of mammalian cell culture. The Committee has pointed out the urgent need for a systematic process of characterizing and certifying cell lines, with provision for the establishment of reference or prototype cultures in long term frozen preservation, as well as an adequate supply of certified seed stocks. Qualified investigators who wish further information about the program should write to Dr. Syverton, Department of Bacteriology, University of Minnesota Medical School, Minneapolis 14, Minn.

The Canadian Society of Plant Physiologists has established a category of corresponding members for plant physiologists outside Canada. Address inquiries to the Secretary of the Society, Dorothy F. Forward, Department of Botany, University of Toronto, Toronto 5, Canada.

A contract between the National Academy of Sciences-National Research Council and the Institute of Inter-American Affairs of the International Cooperation Administration has enabled the **Committee on Preservation of Indigenous Strains of Maize** to present the monograph "Races of Maize in Bolivia" as the latest in the series of publications on the races of maize of Central and South America.

A **Hans Sloane Memorial Fund** has been established to honor the noted doctor and botanist whose immense collections formed the nucleus of the British Museum. To subscribe, or to request information, write to the Hon. Treasurer, Rev. J. Radcliffe, The Manse, Downpatrick, Northern Ireland.

To inquire into the possible physiological role of fast transfer reactions in eliciting specific interactions in ordered macromolecular structures, a **series of seminar lectures** was held at the **Massachusetts Institute of Technology** during the 1960 spring term. Abstracts of these lectures, and pertinent references, are available gratis. Requests should be sent to Francis O. Schmitt, Department of Biology, M.I.T., Cambridge 39, Mass.

Some travel funds will be available for the **Second International Congress of Human Genetics** in Rome, September, 1961. Information may be obtained from F. Clarke Fraser, Department of Genetics, McGill University, Montreal, Canada.

Fellowships and Grants

The United States Army Chemical Corps Biological Laboratories has announced a new grant program planned to support basic scientific research. Areas of investigation being given consideration for support include the genetic, biochemical, and physiological characterization of infectious microorganisms, the host-parasite relationship in airborne infection, and medical entomology. For information, write to the Laboratories, Fort Detrick, Maryland.

The University of Michigan's Center for the Study of Higher Education has announced fellowships available for 1961-62 for persons planning a career in college or university administration. Pre- and postdoctoral fellowships are available. Requests for information should be addressed to: Algo D. Henderson, Director of the Center, University of Michigan, Ann Arbor, Michigan.

Applications are now being accepted in the **National Science Foundation** program of **Summer Fellowships for Graduate Teaching Assistants.** For information write the Fellowships Section, Division of Scientific Personnel and Education, National Science Foundation, Washington 25, D. C.

The Woodrow Wilson National Fellowship Foundation, 32 Nassau Street, Princeton, New Jersey, announces graduate fellowships to students interested in college teaching careers. Information may be obtained by writing to Hans Rosenhaupt, National Director, at the Foundation.

Future Biological Meetings

The Entomological Society of America is holding its annual meeting in Atlantic City, N. J. November 28 through December 1. Contact Dr. M. P. Jones. Society president, Department of Agriculture, Washington 25, D. C. for information. The meeting date which appeared in *In Brief . . . In Biology* (September) was incorrect.

The American Society of Human Genetics will meet May 4-5, 1961, in Atlantic City, N. J. Write Margery W. Shaw, Department of Human Genetics, University of Michigan, 1133 E. Catherine St., Ann Arbor, Michigan, for further details.

Some future international meetings and their information offices are as follows:

International Conference on Muscle as a Tissue, Philadelphia, November 3-4, 1960. Kaare Rodahl, Lankenau Hospital, Lancaster and City Line Aves., Philadelphia 31, Pa.

Pan American Congress of Pharmacy and Biochemistry, Santiago, November 12-19, 1960. Victor M. Cereceda A., Castilla 1136, Santiago, Chile.

Gulf and Caribbean Fisheries Institute, Miami Beach, November 14-18, 1960. James B. Higman, The Marine Laboratory, University of Miami, 1 Rickenbacker Causeway, Miami 49, Florida.

International Symposium on the Etiology of Myocardial Infarction, Detroit, November 16-18, 1960. Thomas N. James, Section on Cardiovascular Research, Henry Ford Hospital, Detroit, Michigan.

Commission for Technical Cooperation in Africa South of The Sahara/ Food and Agriculture Organization of the United Nations, Symposium on Tuberculosis, November 16-22, 1960, Nairobi, Kenya. Apply to the Commission, Pvt. Mail Bag 2359, Lagos, Nigeria.

Symposium on the Diseases of the Liver, Brussels, November 19, 1960. O. Hoste, General Secretary, Colloquia on Gastroenterology, Gouden Handstraat 9, Bruges, Belgium.

Latin American Congress of Neurology, November 27 to December 1, 1960, Santiago. Rodolfo Nuñez, Almirante Montt 485, Dep. 11, Santiago, Chile.

UNESCO Committee of Scientific Consultants for the Preparation of the Travelling Science Exhibition on Oceanography, December 16, 1960, Paris. UNESCO, Place de Fontenoy, Paris 7e, France.

Symposium on Pest Control by Radiation, December, 1960, International Atomic Energy Agency, 11 Kärntner Ring, Vienna 1, Austria.

International Symposium on Crop Protection, Ghent, May 7, 1961. Ing. J. Van den Brande, Institut Agronomique de L'Etat, Coupure Links 233, Ghent, Belgium.

International Congress of Biophysics, Stockholm, July 31 to August 4, 1961. Bo Lindstrom, Department of Medical Physics, Karolinska Institutet, Stockholm 60, Sweden.

International Symposium on the Transmission and Processing of Information, Massachusetts Institute of Technology early in September, 1961. The Chairman of the Organizing Committee, R. M. Fano, M.I.T., Cambridge 39, Mass.

Notes on Biologists

New staff members of the Institute for Advancement of Medical Communication, New York City, are **Walter E. Boek,** formerly with the New York State Department of Health, and **Don M. DeKoven,** formerly of the Rockefeller Institute.

Ismael Vélez, Professor of Botany and Director of the National Science Division, Inter American University, Puerto Rico, will lecture at the University of Cuzco, Peru until December on a Fulbright assignment.

Austin C. Wagenknecht is now with General Mills, Inc., Central Research Laboratories, Minneapolis, Minnesota as Principal Scientist in charge of lipid research in the Fundamental Food Research Department.

The Department of Bacteriology of Indiana University announces the promotion of **Dean Fraser** to a full professorship.

Thomas Kavanagh, of the Department of Plant Pathology, University of Minnesota, is currently working with the Department of Plant Pathology, University College, Dublin, Ireland.

Newly elected President of the National Speleological Society is **Brother G. Nicholas,** Department of Biology, University of Notre Dame, Indiana.

Theodore Delevoryas, formerly of Yale University, is now an Associate Professor in the Department of Botany, University of Illinois.

New members of the Harvard University faculty are: **John Gordon Torrey,** Professor of Botany, and formerly of the University of California; **Henry M. Stommel** who was Physical Oceanographer at the Woods Hole Oceanographic Institution, now Professor of Oceanography; **Matthew S. Meselson,** now working as Senior Research Fellow in Chemical Biology at the California Institute of Technology, will be Associate Professor of Biology.

The University of Rochester reports that **Ernst W. Caspari,** developmental geneticist and formerly Chairman of the Department of Biology at Wesleyan University, has been appointed Chairman of the Department of Biology at Rochester, and that former Department Chairman **Arnold W. Ravin** has been promoted to Associate Dean of the College of Arts and Sciences.

Paul J. Kramer has been appointed Program Director for Biological Sciences for the National Science Foundation's Regulatory Biology program. He replaces **Roy P. Forster,** who returns to Dartmouth College where he is Chairman of the Zoology Department.

Chauncey G. Goodchild, a parasitologist, has been appointed a Charles Howard Candler Professor of Biology at Emory University, where he has been Chairman of the Department of Biology since 1957.

Max C. Shank, Chairman of the Division of Biological Sciences at the University of Illinois Chicago Undergraduate Division, has been awarded a Fulbright research grant for work in Africa where he will work at Makerere College in Kampala, Uganda.

Frederick Palmer Ferguson, formerly Professor of Physiology, University of Maryland School of Medicine, has been appointed Chief of the Research Fellowships Section, Research Training Branch, Division of General Medical Sciences, National Institutes of Health.

Alan W. Donaldson has been appointed deputy chief of the U. S. Public Health Service's Communicable Disease Center at Atlanta, Georgia.

On the occasion of the 500-year celebration of the University of Basel, Switzerland, the honorary degree of Doctor of Medicine was conferred on **Emil Witschi** of the State University of Iowa.

The following appointments and additions to the staff of Yale University's Department of Botany has been announced:

Arthur W. Galston (Plant Physiology), Chairman of the Department. During the 1960-61 academic year when Professor Galston will be on sabbatical leave at the C.S.I.R.O., Canberra, Australia, **Norman H. Giles** (Cytogenetics) will serve as Acting Chairman. **Ian M. Sussex** (Plant Morphogenesis) of the Department of Biology, University of Pittsburgh, and **Diter H. von Wettstein,** of the Forest Genetics Institute in Stockholm, have been appointed Associate Professors. **William S. Hillman** (Plant Physiology) has been appointed Assistant Professor. **John H. Miller** (Developmental Morphology) has been appointed Instructor. **Derald D. Langham** (Genetics), formerly Head of the Departments of Genetics in Caracas and Maracay, Venezuela, has been appointed Lecturer.

Charles F. Ehret, Associate Biologist at Argonne National Laboratory, has been granted a special research fellowship by the United States Public Health Service for studies at the Biophysical Institute of the University of Geneva, Switzerland.

Damon Boynton, formerly Professor of Pomology at Cornell University and until June, 1959, Editor of the *Proceedings* of the American Society for Horticultural Science, is now Dean of the Graduate School at Cornell.

Two new members of the staff of the University of Wisconsin Medical Center are **Jerzy E. Rose,** who will direct the Neurophysiology Laboratory, and **Charles W. Cotterman,** who is Professor of Medical Genetics.

Ionel Rapaport, Assistant Professor, Psychiatric Institute, University of Wisconsin, has been appointed Editor for the United States of *Medicina Universalis,* a new medical periodical published in six languages.

William McDowell Hammon, Professor and Head of the Department of Epidemiology and Microbiology of the Graduate School of Public Health, University of Pittsburgh, has been appointed to a two-year term on the National Advisory Cancer Council.

C. Francis Byers, formerly of the University of Florida, is now Chairman of the Division of Natural Sciences, Elmira College, Elmira, New York.

George M. Briggs, formerly Executive Secretary of the Biochemistry and Pharmacology Training Committees, Division of General Medical Sciences, National Institutes of Health, is now Chairman of the Department of Nutrition in the College of Agriculture at the University of California at Berkeley.

Keith R. Porter, who has been a Professor at the Rockefeller Institute since 1956, will become Professor of Biology at Harvard University in July, 1961.

Edward D. Crabb has retired as Professor Emeritus at the University of Colorado, but will continue as Director of the University's Cancer Research Foundation on the Boulder campus.

Oregon State College, Corvallis, reports the appointment of **Kenton L. Chambers,** formerly of Yale University, as Associate Professor in the Department of Botany.

An honorary degree of Doctor of Science was bestowed upon **Paul C. Mangelsdorf,** Director of the Botanical Museum, Harvard University, by Park College, Parkville, Mo.

Richard D. Lane has been named Director of the Central States Forest Experiment Station, Columbus, Ohio. He succeeds **William G. McGinnies,** who has retired.

James Walter Wilson, Professor of Biology at Brown University began a four-year term on the National Advisory Council October 1.

Reports of the Election of New Officers from the Societies

New officers for 1961 of the **American Society of Human Genetics** are: President Elect, F. Clarke Fraser; Vice President, Eldon J. Gardner; Treasurer, Charles M. Woolf.

For the term beginning July 1, 1960, new officers were reported by the **American Physiological Society.** President, J. H. Comroe, Jr., University of California Medical Center; President-Elect, Horace Davenport, University of Michigan School of Medicine.

The American Society of Zoologists reports the following new officers: President, Alfred Romer, Harvard University; Secretary-General, Gairdner B. Moment, Goucher College; Treasurer, Alexander Wetmore, Smithsonian Institution.

New officers of the Board of Governors of the **American Academy of Microbiology** are: Chairman, C. A. Evans; Vice-Chairman, W. W. Umbreit; Secretary, R. D. Reid; Treasurer, F. B. Gordon.

Walter S. Root, College of Physicians and Surgeons, New York City, succeeded A. J. Goldforb as Secretary-Treasurer and Managing Editor of the *Proceedings* of the **Society for Experimental Biology and Medicine.**

At the 40th Annual Meeting of the **American Society of Mammologists,** June 19-22, the following new officers were elected: President, Stephen D. Durrant, University of Utah; Vice Presidents, Emmet T. Hooper, University of Michigan, and I. McTaggert Cowan, University of British Columbia.

Recent Deaths among Biologists

Hugh H. Bennett, retired first chief of the U. S. Soil Conservation Service, at Burlington, N. C., July 7.

Theodor K. Just, Chief Curator, for many years, of the Department of Botany, Chicago Natural History Museum. June 14.

Carroll E. Cox, Professor of Plant Pathology, Department of Botany, The University of Maryland, College Park. June 24.

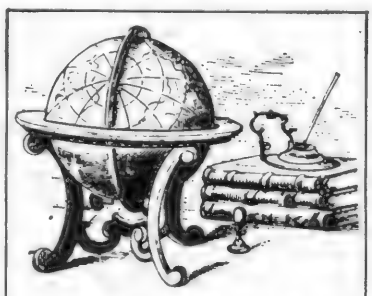
Ivan M. Johnston, Associate Professor of Botany, Harvard University. May 31.

Brenton Reid Lutz, Emeritus Professor of Biology and former Department Chairman, Boston University. June 22.

Cruz A. Gallastegui, Director Mision Biologica de Galicia, Pontevedra, Spain, formerly of the Connecticut Agricultural Experiment Station. June 7.

Stanley B. Freeborn, entomologist, and Chancellor Emeritus of the University of California at Davis. July 17.

Angel Cabrera, an Honorary and Charter member of the American Society of Mammalogists, La Plata, Argentina. July 7.



New AIBS Officers: Dr. Tracy M. Sonneborn, Professor of Zoology at Indiana University, was elected President of the American Institute of Biological Sciences at the annual meeting of the Governing Board in Stillwater, Oklahoma, August 27. He will take office January 1, succeeding **Dr. James G. Dickson. Dr. Bernard S. Meyer,** Professor of Plant Physiology, Ohio State University, was named Vice President. **Dr. F. P. Cullinan** was re-elected Secretary-Treasurer. **Dr. George Beadle,** Chairman of the Department of Biology at California Institute of Technology and a Nobel Prize winner, was named an honorary adviser of the Board. **Dr. Dorothy Matala,** Iowa State Teachers College, was elected to the Executive Committee.

The third meeting of the AIBS **Committee on Translations** was held at the AIBS offices in Washington on July 12, 1960 under the chairmanship of Fred R. Cagle. In addition to the members of the Committee, representatives were present from the National Science Foundation, the National Institutes of Health, the U. S. Department of Agriculure and the Academy of Natural Sciences of Philadelphia. J. Levitt, Professor of Botany at the University of Missouri, was welcomed as a member of the Committee to represent the Botanical Sciences.

Educational Activities announces the AIBS Visiting Biologist Program for Colleges and High Schools for the 1960 and 1961 academic year. For information concerning the college program write: The Visiting Biologist Program for Colleges, AIBS.

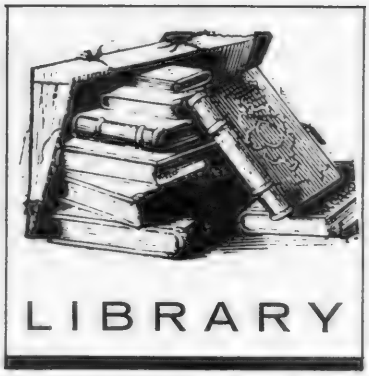
For information pertaining to the high school program write: The Visiting Biologist Program for High Schools, AIBS.

The college program is sponsored by the National Science Foundation and the Atomic Energy Commission; the high school program by the National Science Foundation. It is suggested that all schools interested in participating in this year's program submit requests as early as possible.

The AIBS has received funds for about **25 travel grants** to enable American scientists to participate in a symposium on Comparative Endocrinology at Oiso (Tokyo), Japan, June 6–10, 1961. Applications, obtainable from AIBS, must be filed by Nov. 30.

The AIBS has been awarded a grant of $12,000 by the **National Science Foundation** for the support of basic research entitled "Study of the Feasibility of the Centralization of Plant Sciences."

The Foreign Visiting Lecturers Program, which brings prominent foreign biologists to American colleges, begins its first academic year. For information write: The Foreign Visiting Biologists Program, AIBS.



One copy of each publication submitted for listing should be sent to the Editor, AIBS BULLETIN, American Institute of Biological Sciences, 2000 P Street, N.W., Washington 6, D.C. Only books published within a year of receipt will be reviewed. Books marked with a ★ are those published by Bulletin advertisers.

Natural History of the Phlox Family. Vol. I. Systematic Botany. VERNE GRANT. xvi, 280 pp., illus. Martinus Nijhoff, The Hague. (1959) 19 Guilders.

In the first of two projected volumes, the author lays the taxonomic groundwork essential for the effective presentation of the biological information that will lead to an understanding of evolution in the Phlox family (Polemoniaceae). The second volume will deal with the reproductive biology of this family. In general, then, the descriptive material is treated in the present volume and the experimental findings will appear in the sequel.

Comprehensive studies, covering the taxonomy, ecology and genetics of a single large phyletic unit, whether a genus or a family of plants or animals, have already contributed much to the development of a general theory of evolution. The author of the present volume treats the Phlox family as a model of evolution in a group of higher plants. However, the family is not viewed as a model in the abstract sense of the theoretical and mathematical evolutionist, but rather in the sense of the naturalist. The physical setting of this model consists of three continents, but primarily western North America. Five tribes, eighteen generic lines, and approximately 316 species (most of which are highly complex in themselves) comprise the dynamic elements in the system.

This broad comparative study of the Phlox family begins with a taxonomic survey, followed by chapters dealing with chromosome numbers and karyotype evolution, phylogeny, and phytogeography including migrational history. New taxa or nomenclatural changes, either at the specific or section level, occur in the genera *Gilia, Linanthus, Loeselia*, and *Navarretia. W. C. Steere. The New York Botanical Garden.*

The Neurochemistry of Nucleotides and Amino Acids. R. O. BRADY and D. B. TOWER, ed. xii + 292 pp., illus. John Wiley and Son, New York. (1960) $10.00.

This small volume, containing the papers and discussion presented before the Section of Neurochemistry of the American Academy of Neurology, is divided into two parts. The first of these includes papers on the reactions of guanosine, cytidine, uridine and pyridine nucleotides and polynucleotides. Each report is short and something is gained by allowing the presentation of only one nucleotide at a time. An elementary introduction to the type-reactions of nucleotides precedes this section. Whenever information is available the occurrence and metabolism of nucleotides by brain and nerve are noted.

The second part is concerned with aromatic amino acids and derivatives, γ-aminobutyric acid, the phosphatidic bases, asparagine, glutamine and protein. A greater number of metabolic studies have been performed with brain in this area and these are reported. Particularly useful is a conservative—in the best sense of the word—and constructive summary by Tower of our knowledge of amino acid metabolism of brain.

There are errors to be found in this book but these are largely due to a two-year lapse between presentation and publication. Although the contributors rely on their own work, a determined effort was made to summarize a given field. Certainly this is the best résumé of biochemical activity in the topics under discussion as it applies to the nervous system.

This volume should be taken as evidence that the field of neurochemistry is receding from the position referred to by the maestro who commented after hearing a young pupil's work, "There is much here which is new and which is good. But the good is not new and the new is not good." Indeed, it is impressive to find that several areas of biochemistry are being developed solely as the result of such concentration.

From the viewpoint of the biochemist not in this subspecialty, the first section provides a useful summary of nucleotide metabolism in general and the second, a view of some of the possible physiological properties of amino acids. *William B. Jakoby, National Institutes of Health.*

Plant Pathology. Vol. II "The Pathogen". J. G. HORSFALL and A. E. DIMOND, ed. 715 pp. Academic Press, New York. (1960) $22.00.

The second of this three-volume treatise deals with plant pathogens—the causal agents of plant disease—their reproduction, modes of action, and their control by the use of chemicals. Editors Horsfall and Dimond and the contributing authors of this second volume are to be highly commended on the fine quality they have maintained throughout. The editors introduce the volume with a stimulating discussion of plant disease causation with emphasis on the etymology of terms that have been used to connote its events and processes. The second chapter is an interesting essay by George L. McNew on "The Nature, Origin and Evolution of Parasitism." The author cites disease cases to establish correlations between types of host-parasite relationships and disease responses to environment, to mineral nutrition, to host genotypes and to methods of control. Many readers will find the proposed correlations highly debatable due to existing contrary evidence or to the obviously primitive state of our knowledge or of host improvement in cases used as supporting examples. The effort will, however, add stimulus to research on host-parasite physiology which is one of Dr. McNew's stated purposes.

The following chapters of the volume are primarily reviews that are logically organized, thorough, and written in an interesting, readable style: F. C. Bawden, "Multiplication of Viruses"; Lilian E. Hawker, "Reproduction of Bacteria, Actinomycetes, and Fungi"; Vincent W. Cochrane, "Spore Germination"; Sydney Dickenson, "The Mechanical Ability to Breach the Host Barriers"; R. K. S. Wood, "Chemical Ability to Breach the Host Barriers"; T. S. Sadasivan and C. V. Subramanian, "Interaction of Pathogen, Soil, Other Microorganisms in the Soil, and Host"; R. A. Ludwig, "Toxins"; E. W. Buxton, "Heterokaryosis, Saltation and Adaptation"; T. Johnson, "Genetics of Pathogenicity"; R. E. F. Mathews, "Virus Inactivation *in Vitro* and *in Vivo*"; Hugh D. Sisler and the late Carrol E. Cox, "Physiology of Fungitoxicity"; Saul Rich, "Fungicidal Chemistry"; and M. W. Allen, "Nematocides".

The three volumes in this series, along with the Golden Jubilee volume

of the American Phytopathological Society ("Plant Pathology", University of Wisconsin Press, 1958) are valuable and timely references for graduate student instruction. It is unfortunate that the price of these Academic Press volumes will so sharply limit the convenience of their use for these purposes. *J. R. Shay, Head, Department of Botany and Plant Pathology, Purdue University.*

Comparative Morphology of Vascular Plants. ADRIANCE S. FOSTER and ERNEST M. GIFFORD, JR. xi + 555 pp., illus. by Evan L. Gillespie. W. H. Freeman, San Francisco. (1959) $9.00.

It would be difficult to be anything but enthusiastic about this excellent presentation of morphological facts and interpretations which reflect the experience and acumen of the authors. Fully one fifth of this book is devoted to laying a firm morphological foundation for a better comprehension of the chapters which follow. The latter are devoted to a more or less comprehensive discussion of the four principal subdivisions of tracheophytes: Psilopsida, Lycopsida, Sphenopsida and Pteropsida. Each chapter is logically and systematically broken down into important topics of discussion so that the student has in effect a ready-made, easily followed outline of study. An introductory paragraph presents significant information and orients the reader in time and space. A brief synoptical classification for each subphylum and important taxon of lower rank is followed by sections covering facets of morphology and development within the taxon in question. A number of subjects, almost unique to this work, form a welcome addition to the subject matter contained in many of our heretofore published morphological texts, e.g., sections on embryogeny, chromosome numbers and morphogenesis. The well executed drawings are an important complement to the text, and the numerous half-tone illustrations further increase the value of the printed word.

In any comprehensive text, the writer is confronted with the problems of emphasis and balance, what to include and what to exclude, what to emphasize and what to de-emphasize. The reviewer is aware of these conflicts which must plague all authors; nevertheless, it seems that in this work at least one important body of morphological data has been almost completely slighted, and information on the most important group of extant plants has been de-emphasized in favor of fuller treatments of lesser categories.

Although the authors allude to secondary xylem in several places in the later chapters of the book, and mention a number of sources where further information on the subject may be gathered, token attention only is given this evolutionarily and structurally significant portion of the plant body of the "Spermatophyta." Perhaps in no other plant tissues are lines of evolution more clearly shown than in the cells and tissues of secondary xylem. In my opinion, this constitutes a serious indiscretion.

At the beginning of chapter 18, which deals with the general morphology and evolution of angiosperms, the authors stress that this group of plants far exceeds ". . . in number and diversity of form and structure all other major groups of living plants . . ." Yet, fewer than 100 pages of the 439 pages dedicated to the discussion of taxa of vascular plants are utilized for the angiosperms. Perhaps this has been the full intent of the authors, since recent "plant anatomy" texts have been largely devoted to the structure of the flowering plants and have neglected the lower taxa.

There is no question that Foster and Gifford's text constitutes a new standard of excellence upon which future writers of plant morphology books will have to compare their own works. Admirably suited for the classroom, *Comparative Morphology* will be equally desired for the reference shelf and the laboratory. This volume is indeed a lively addition to a previously somewhat stereotyped field of publication. *William L. Stern, Division of Woods, U. S. National Museum.*

Mites, or the Acari. T. E. HUGHES. University of London: The Athlone Press, London and Essential Books, Fair Lawn, N. J. 225 pp., 52 plates of line drawings. (1959) $6.75.

An excellent treatment of the general biology of mites for the zoologist or serious layman. Chapters on free-living acari, associations with other animals, parasites on mammals, birds, invertebrates, etc., endoparasitism, plant parasites, mites as vectors of viruses and bacteria, morphology (114 pages) of the cuticle, exoskeleton, sensory organs, nervous system, appendages, alimentary canal, reproductive system, development, and respiratory system, a 9-page chapter on classification. One could wish that relatively less space was put to morphology and more to physiology and taxonomy. The chapter on taxonomy should have been illustrated to aid in identification, perhaps to superorder or family with some indication of the most common genera and species. There is no mention of the numbers of species. Habitat ecology is excellent. The index is poor; for example, strawberry mite is not in index even though *Tarsonemus pallidus* is indexed and described. Frequently or mostly the genera figured are not indexed to the pages on which drawings are shown but only to discussions in text. There is nothing in the book on how to study the creatures. *Ralph Buchsbaum, Professor, University of Pittsburgh.*

Grasslands. HOWARD B. SPRAGUE, ed. 424 pp. Publ. No. 53, American Association for the Advancement of Science, Washington, D. C. (1959) $9.00 ($8.00 to AAAS Members).

The vast scope of grassland studies is well demonstrated by this volume containing 44 articles. They were written by participants in 8 symposia, each lasting a half-day, given as part of the program of the AAAS. on December 27-30, 1956, in which papers on specific subjects were given in various sections and related societies. Many people took part in arranging the programs under the general chairmanship of H. B. Sprague in Section O. The purpose of the symposia was to present a review of the current development in forage production, engineering aspects, forage utilization, nutritive significance of forages, climatology, ecology, and range management.

Most of the articles describe in summarized form the accomplishments and current problems in a wide array of subjects, e. g., "Mineral Problems in Forage Utilization," "Ecological Principles in Range Evaluation," "Equipment for the Establishment and Maintenance of Grassland," and "Development and Use of Improved Varieties . . . ." The articles vary considerably in merit and usually there is no close connection between them, such that the book resembles a collection of journal articles. They do present much information that can be quickly assimilated; therefore, the collection is valuable in giving a picture of grasslands as a whole and in presenting the current status in many fields in one volume. References in most of the articles are needed by readers who require more detail.

The book reveals in a striking manner the variety of disciplines that are needed in the management and improvement of natural and artificial grasslands. Both kinds are more complicated than a field of corn or cotton, for they consist of a mixture of grasses, legumes, and other herbs, which are usually perennial. Each population has its own requirements and tolerances, responds in a specific manner to environmental conditions, and varies in competitive capacity ac-

cording to the microenvironment. Ecological succession must be reckoned with; how to prevent deterioration of tame pastures, how to improve native pastures by using succession as a management tool. The trend today to improve rangelands by the seeding of single species presents dangers such as the loss of a varied diet furnished by an assortment of species, and the loss of wild plants which may have as yet important undiscovered assets in their germ plasm. Some of the papers point up the need for preserving areas of all types of grasslands in order to maintain genotypes, permit the natural formation of new ones, allow for the discovery of now unknown organic compounds, and provide for the study of population and community processes without interference by man. Nature has ways of functioning that man certainly is not aware of.

This book is a welcome addition to the growing and needed literature on grasslands. *Herbert C. Hanson, Department of Biology, Catholic University of America.*

Handbook of Pest Control. ARNOLD MALLIS. 1132 pp., illus. MacNair—Dorland Company, New York. (1960) $12.50.

Arnold Mallis has succeeded in presenting a tremendous amount of valuable information in a readable and enjoyable fashion. His discussion of pests includes rats and mice, silverfish, springtails, cockroaches, crickets, earwigs, termites, decay fungi, woodboring and related beetles, book lice, bedbugs, clothes moths, carpet beetles, ants, bees and wasps, stored product pests, lice, fleas, flies, gnats, mosquitoes, spiders, mites, ticks, and a chapter on several miscellaneous household pests of less importance.

Most of the chapters are headed by a delightful short poem about the subject of the chapter, *e.g.*, "The Ant" (Ogden Nash):

"The ant has made himself
illustrious
Through constant industry
industrious.
So what?
Would you be calm and placid
If you were full of formic acid?"

Each chapter includes information on the life cycle of the pest and descriptions and pictures of identifying characteristics. There is a short discussion of any diseases transmitted and the specific damage done by the pest as well as some interesting antidotes concerning past superstitions. Mallis quotes Ewing (1933) concerning the old idea that only "medical" choreographers could save people who had been bitten by a tarantula. If only the right tune could be found, the music and dancing could cure these people. The wild antics that were devised to shake off the poison of the tarantula is said to have resulted in a dance called the tarantella.

In addition to all of this information there is the expected material on control. The signs to look for in detecting household pests are discussed, methods of trapping, baits used, poisons, insecticides, and ways of keeping the pests out of the house are presented in a clear precise manner. There is a separate chapter summarizing the chemicals available for the control of household pests and the methods of applying these chemicals. The last chapter deals with the various methods of fumigation and the dangers involved in inexperienced hands.

The chapters are well documented with many direct quotations and the source of the literature is cited at the end of each chapter.

The author has done a great deal of research for his book and he has made it an up-to-date source of nearly any information a layman or professional entomologist could want concerning the household pests of man and their control. It is a very valuable reference book from that standpoint. *Dorothy Feir, University of Wisconsin.*

Elementary Statistics With Applications in Medicine and the Biological Sciences: FREDERICK E. CROXTON, 376 pp. (with statistical tables), illus. Dover Publications, New York. (1959) $1.95.

This book is an unabridged and corrected republication of the work first published in 1953 under the title *Elementary Statistics With Applications in Medicine.* The present edition is paperbound.

This book gives detailed procedures for performing many of the standard calculations used in statistical analysis. Multiple correlation up to four variables and analysis of variance through the two-way classification are presented along with the commonly used tests of significance including the chi-square test. The first seven chapters are devoted to descriptive statistics including some useful material on the preparation of graphs and tables. The eighth chapter discusses the properties of the normal, the binomial and the Poisson distributions. The final chapters, nine through twelve, consider some of the inferential aspects of the statistical method with discussions of various tests of significance. The appendix contains fourteen tables to be used in connection with the procedures outlined in the text. Most of these tables are included in all elementary books of this kind but there are four tables not commonly found: two tables giving sampling limits and confidence limits using the sample variance and two tables to be used in testing for skewness and kurtosis deviations from a normal distribution.

The author expresses the hope that the book will be useful to workers in the medical and allied fields and does not imply that the work should be used as a text. It is this reviewer's opinion that while one could learn much from this book without a previous exposure to statistics the inferential ideas are not set out in such a way as to be readily presented as a body of statistical thought.

Each of the techniques presented is through an example worked in detail and in most cases involving actual data. This touch of reality is an important consideration. The procedure has also led to a wealth of examples which range far and wide through the biological fields.

In an effort to avoid mathematical notation the author has used a glossary of symbols needed in each chapter which has led in the direction of excessive symbolism. One example of this is in defining "s = sample standard deviation" and "$\hat{\sigma}$ = estimate of the population standard deviation" (Chapter 9) when a single properly defined symbol would suffice for both. This practice may make easier for some the understanding of the inferential ideas presented and the performance of necessary calculations. Others will find the symbolism confusing. *Robert J. Monroe, School of Agriculture, North Carolina State College.*

★Radiation, Genes, and Man. BRUCE WALLACE and TH. DOBZHANSKY. 205 pp., illus. Henry Holt, New York. (1959) $3.50.

Much of the popular confusion about the genetic consequences of exposing human populations to increased levels of ionizing radiation has stemmed from the misleading statements of non-geneticists. It is fortunate, therefore, that two auhors who have made outstanding contributions to our knowledge of population genetics and of the effects of radiation on populations of laboratory organisms should undertake to write for the educated layman a carefully reasoned book dealing with the probable genetic effects in man.

The book will serve to dispel two popular misconceptions. Among those who are unfamiliar with the very large amount of careful research into the genetic effects of irradiation, carried out over a period of more than thirty years, there has been some

tendency to dismiss the likely effects in humans as "unproved" or "speculative." On the other hand, those faced with making practical decisions, and unaware of the major gaps in our present knowledge, have sometimes been overly hopeful about getting adequate guidance from "the experts"—this being a much more economical approach, in the short run, than investing in appropriate programs of genetics research. Both the body of research already done, and some of the specific needs for research, are very adequately dealt with in this book. It is clearly stated that "the greatest uncertainty in estimating the magnitude of genetic damage results . . . from an insufficient understanding of the behavior of mutants in populations."

Since knowledge of the consequences of mutation in human populations has, understandably, lagged behind that in organisms which can be studied in a laboratory, it is gratifying to be reminded that "the difficulties of human genetics should not . . . be unduly exaggerated," and that "some types of information are available for man which are not available for other biological species . . . Man is the only species in which every individual is routinely given a name and in which his physical location is known at virtually every moment of his life." It might also have been added that vastly more effort is spent on observing individual cases of physiological and morphological abnormality in man (through his demands upon medical services) than could ever be invested in the experimental study of populations of lower organisms. The extensiveness of the resulting documentation, rather than its limited quality, constitutes the main impediment to its more complete use.

That the dose to reproductive tissues from the medical uses of X rays in many countries now equals or exceeds that from natural background radiation is made clear in an early chapter. So also is the need for nuclear power in the future. One gathers that the annual production of electrical energy in the United States has doubled in a period of less than ten years, that the proportion derived from water power is relatively small (less than 20 per cent in 1955) and is rapidly diminishing, and that the increase comes mainly from the burning of fossil fuels (coal, gas, and oil) which are irreplaceable. Energy from nuclear fission, and eventually from nuclear fusion, will undoubtedly be needed in rapidly increasing amounts.

Since nuclear power, rather than medical X rays, may in the future constitute the chief source of exposure of human populations to ionizing radiations, it is unfortunate that the setting of maximum permissible exposures for whole populations is not discussed. To the reviewer this seems a serious omission. Maximum levels are presently being set by various national and international bodies. The reader of this book would not be far wrong if he inferred that the choice must of necessity be largely arbitrary and based on inadequate knowledge. And yet, the choice should nevertheless reflect the advice of those geneticists who have devoted the most thought to the problem of radiation effects. If these have no practical guidance to offer, to whom else should the task fall?

As a statement of the known principles, and of the complexities of the subject and the needs for further knowledge, the book has no equal. It should serve as an authoritative guide for those who want insight rather than easy solutions. *Howard B. Newcombe, Atomic Energy of Canada Limited.*

Symposium on Basic Research. DAEL WOLFLE, ed. xx + 308 pp. Publ. No. 56, American Association for the Advancement of Science. (1959) $3.00 (AAAS members, $2.50).

There are two things which set this symposium volume apart from most of its kind: it was published within a few months of the event, and the summary by the editor is an excellent synthesis of the actual papers and, evidently, of the discussions. The authors include many notables, from J. Robert Oppenheimer and President Eisenhower to Allen V. Astin of the Bureau of Standards (whose paper on basic research in government laboratories is one of the most interesting in the book), and virtually all the foundation directors. It is hard to summarize a summary; those interested in ideas about basic research or in reinforcing their own views about "science for science's sake" should read the book for themselves. *J. W. Hedgpeth, Pacific Marine Station, College of the Pacific.*

Marine Boring and Fouling Organisms. DIXY LEE RAY, ed. University of Washington Press, Seattle. xii + 536 pp. (1959) $8.50.

Studies of marine organisms of economic importance are amazingly diverse, ranging from pure taxonomy, old fashioned natural history and esoteric enzyme analyses to straightforward matters of piling preservation and noxious antifouling compounds. The subject provides a happy meeting ground for longhaired ecologists and crew-cut corporation chemists, and it is sometimes hard to distinguish between what is "basic" and what is "applied" among the results of such a symposium as this. Nor is the subject restricted to marine organisms since termites and fir trees receive some attention. Nevertheless the papers form an integrated whole, in contrast with the proceedings of some other symposia. Perhaps this is because almost everyone identified with the subject of marine borers was at the symposium, and its insular location added a sense of geographical as well as intellectual unity. Those who could not attend will recognize the importance of the volume for their work, while marine biologists in general will need only a glance to realize it should be in their libraries. *J. W. Hedgpeth, Pacific Marine Station, College of the Pacific.*

Manual of Vegetation Analysis. S. A. CAIN and G. M. DE OLIVEIRA CASTRO. 325 pp. Harper and Brothers, New York. (1959) $7.50.

The chief purpose of the authors in writing this book is to present and explain methods and techniques that are useful in the analysis of vegetation. Many procedures for securing quantitative data are given, but it is pointed out also that there is always room for judgment and even intuition which are required in the integration of analytic data on vegetation that is continuously under the influence of a variable set of environmental conditions. In the investigation of vegetation three main phases can be recognized: reconnaissance, analysis, and integration or synthesis. According to the authors the first of these is largely an art, while the other two are scientific.

This manual may be considered as having four main subject matter divisions: floristics, the community, major vegetation types of the world with special reference to the tropical rain forest, and characteristics of vegetation and their measurement. In general each of these major topics is treated comprehensively with numerous inclusions of historical, explanatory, and illustrative material from worldwide literature. Many applications are made to the tropical rain forest, for, as Cain states in the Preface, the first draft of the book was made when he was on a Technical Assistance Mission in Brazil, and where, with Castro, phytosociological concepts and methods were used in investigations of the vegetation.

These applications to tropical conditions is a noteworthy feature of the manual.

Floristics is treated rather briefly in the second chapter, with the evident purpose of furnishing background for the following parts. The third chapter deals with the community, emphasizing the synusial structure. The fourth chapter, occupying 61 pages, is an extended treatment of the major vegetation types of the world with the tropical rain forest used as an example. Part of the concluding statement on the rain-forest formation is well worth quoting.

"It is obvious that rain forest (in a generic sense) cannot be treated quantitatively. This, however, by no means suggests that local and even regional quantitative studies are not desirable and possible. They are. Although to know a local portion of a formation well does not permit generalization, it does provide a basis for a fuller comprehension of a larger and extremely complex whole" (p. 103).

The remaining 8 chapters of the book are devoted mainly to characteristics of vegetation and their measurement, and include abundance, frequency, coverage, presence, constance, fidelity, and life-form. Methodology includes such topics as primary and intensive surveys, sampling procedures, combinations of date on characteristics, and graphic methods of presentation.

The format of the manual is very good, with apparently high quality paper, and type that is easy to read; it has a good "feel." There are 45 figures (none half-tone) and 74 tables. The glossary contains about 230 terms and the literature citations number 425. The index is rather brief.

This manual is a welcome addition to the growing number of books on the analysis of vegetation, for it makes available to the student many concepts and methods as well as applications in their use. It apparently is designed more for advanced courses in ecology and for research workers rather than for the beginner. The authors emphasize that the methodology used in vegetation analysis must be determined by the objectives of the specific study and by the circumstances under which the study is conducted. This is certainly true, for careful thought must be given to the concepts and characteristics or qualities of the vegetation as they bear on the particular problem before methods which will yield the best answers can be chosen. *Herbert C. Hanson, Department of Biology, Catholic University of America.*

Evolution After Darwin. Vol. 1. The Evolution of Life; its origin, history and future. 628 pp. Vol. 2. The Evolution of Man; mind, culture and society. 473 pp. Vol. 3. Issues in Evolution (to be published in the Autumn of 1960). SOL TAX, ed. The University of Chicago Press. 1960. Vols. 1 and 2, $10 each; Vol. 3, $7.50; all three volumes, $25.

In November, 1959, a group of about fifty distinguished scientists from eight nations met in Chicago to celebrate the Centennial of the publication of Darwin's *Origin of Species.* Fortunately for the participants and others able to attend the Celebration, this great spate of papers was not read publicly. Copies had been previously circulated among the participants; the purpose of the five day gathering was merely to discuss what already had been written. Vol. 3, not yet published as this is written, is scheduled to contain Sir Julian Huxley's convocation address, a series of papers on the relation between science and spiritual values, the record of the Celebration, the transcribed (and edited) texts of the discussions and an Index to all three volumes.

Obviously this cannot be a proper review of the first two volumes; the space allotted would scarcely be sufficient to list the names of the authors and titles of their papers. A statistically legitimate field sample of the careers of this "population" of eminent students (taken from available biographic indices) shows that the mean of their active professional careers has extended over approximately forty years. Here, therefore, is unfolded before the reader the conclusions of a combined two thousand man-years of intensive study of the general problem of biological evolution within the parameters of modern knowledge and thought. The result is not light summer reading.

The quotable passages are seemingly endless and, in paraphrase, doubtless will become high spots of innumerable erudite lectures before our students for years to come. This marshalling of great masses of data covers such a broad spectrum of biological knowledge and the summary of ideas so far-reaching, so indispensable to modern thought, that no biologist—if he aspire to that protean title—can afford not to have these volumes always close at hand.

We have come a long way since the publication of the *"Origin."* The present series of papers points up, as nothing else has done so well, the distance we yet have to go before we really understand the problem. Some of the authors argue that we may never understand it in its entirety at the present evolutionary level of the human mind. Others, as scientists standing before a jury of their peers, have gone beyond the question of "How" and have dared ask "Why." Perhaps the time is now ripe for biologists to cease tossing this latter problem into the laps of the philosophers and make an honest effort to ascertain whether there really is a scientific approach to this ultimate of all bioevolutionary questions. *W. H. Camp, Botany Department, The University of Connecticut.*

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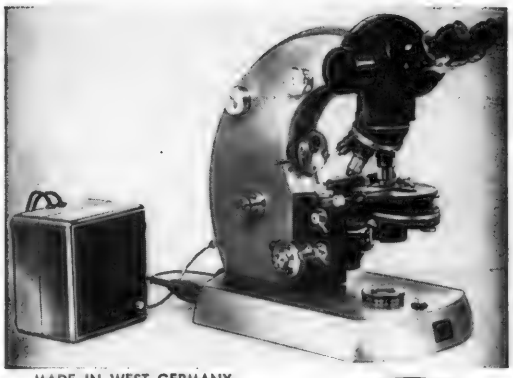

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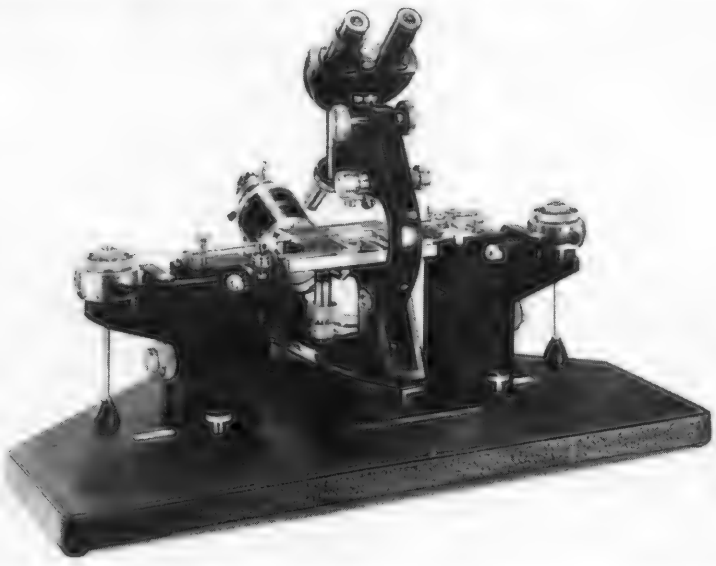

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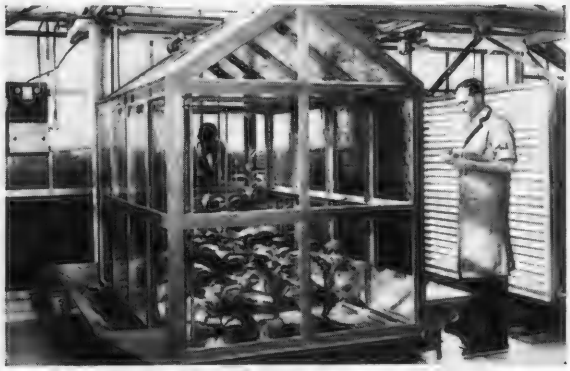
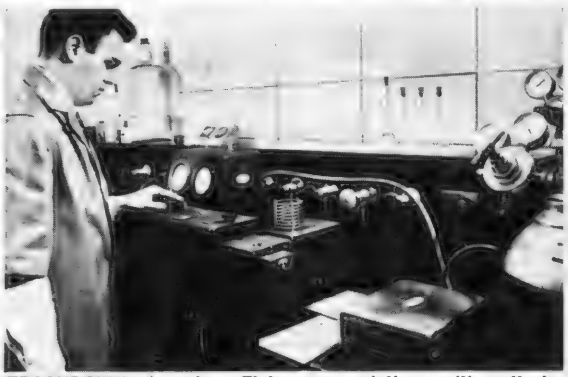
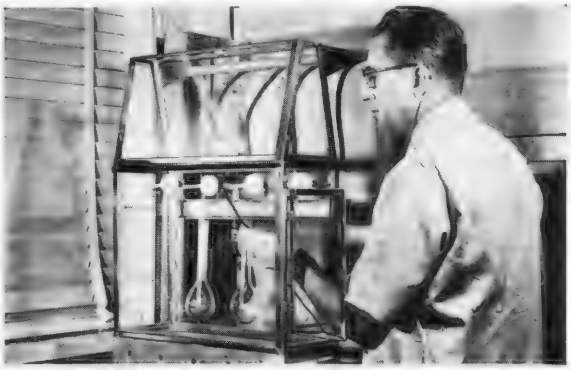


HAVE ISOTOPES—WILL TRAVEL: No scientific detective story is complete without radio isotopes. American Tobacco has pioneered in radiological studies of tobacco. In this new, ultramodern laboratory, such studies as raising tobacco in a radioactive CO_2 atmosphere are conducted for test purposes.

THE HEAT'S ON: To answer such vital questions as the temperature and the combustion products formed at the burning zone in tobacco, the research laboratory is equipped with X-ray equipment (left), tobacco-burning equipment (center) and temperature-recording device (right).



TRACKDOWN: American Tobacco specialists utilize all the important analytical instruments now available to test and examine tobacco and materials used in tobacco. Here, in one of countless tests, a flame photometer determines mineral constituents of tobacco.



A SOLID CASE: A typical American Tobacco invention is the cigarette-smoking machine, now widely used throughout the industry. The machine collects nicotine and smoke solids on a filter. Scores of tests have been developed to examine the collected solids.

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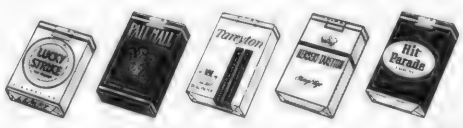

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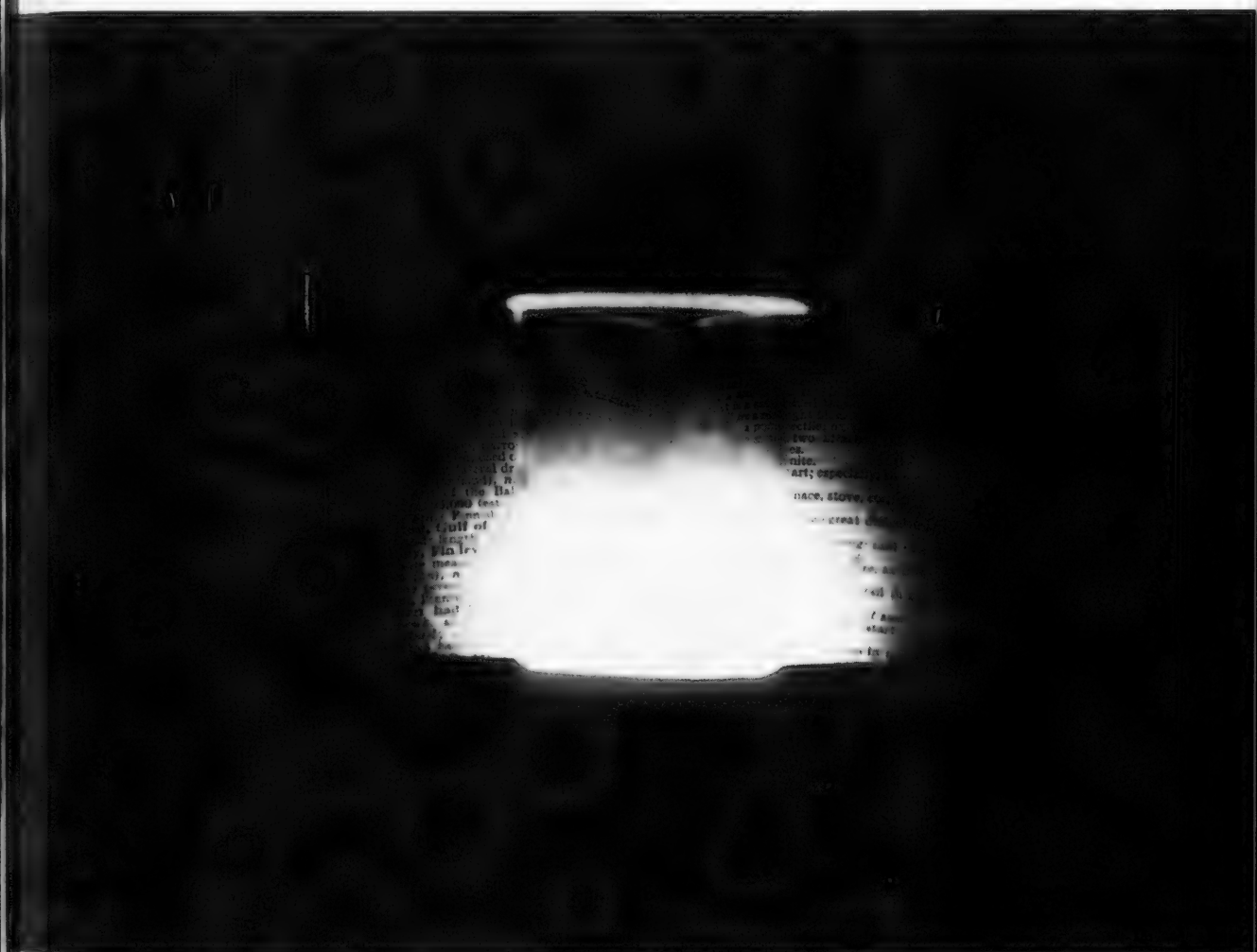

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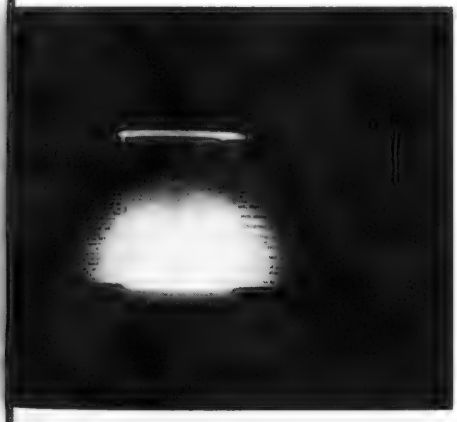

Cover Picture: The beaker contains 5 grams of dehydrated firefly tails (approximately 1250 tails) activated by 2 grams of adenosine triphosphate. Photograph was taken by SCHWARZ BIORESEARCH, INC., Mt. Vernon, New York, using a Crown Graphic camera, f:4.5, open lens for duration of firefly light (45 seconds), Kodak Tri-X film.

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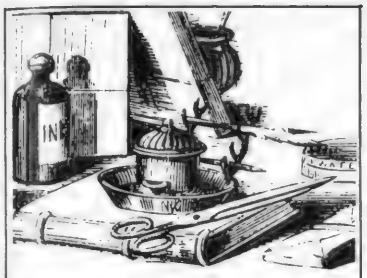

LETTERS

James Bonner's "Thoughts about Biology" in the October Number of the AIBS Bulletin was read with interest. Of course it raised questions which he made no attempt to meet. It would have been more illuminating if he had defined his concept of biology and what he expects of it. One thing we do get from him is that biology changes because he has seen it change. I am surprised that he should labor the point. As a matter of fact the study of living organisms has been in a state of flux for a very long time. It may be that Aristotle began it. Certainly such men as Linnaeus, Cuvier, Agassiz, Darwin, Huxley, Mendel, Haeckel, Asa Gray, D. H. Campbell and a host of others changed current conceptions and kept things moving in spite of attempts to fix them in rigid molds and to prevent change in ideas.

I began to study animals and plants seriously 75 years ago and have continued to the present day to study them. Of course at that time there were other subjects too which every educated person was supposed to know, such as languages and their literature, including a sound knowledge of how to express one's self in spoken and written English, subjects sorely neglected in recent time. At that time there was no such word as biology, at least it was not known in the United States. I well remember when we first began to see it in print. Animals were studied by zoologists and plants by botanists, while some gifted people studied all kinds of living organisms and were real naturalists. The botanists and zoologists during the first half of my life actually knew the organisms they studied—knew them in their native habitat with all that that implies.

As early as 1890 I noticed great changes as enthusiastic young men returned from Germany with methods and ideas new to this country. Through the intervening years fashions in topics of study and methods of research have come one after another, waxed great, then gradually been replaced by a newer mode. As a result we have botanists who know no plants and zoologists who know no animals although they may become very learned in some minute phase of their structure or their reaction to certain stimuli.

Each new fashion or advancement in research was hailed as just the thing to solve all life's mysteries, sometimes as leading the way to creating life in the laboratory. Always just around the corner was the answer to all the riddles. It would be boring to relate all the varying methods of attack witnessed during my years of study. Some of these methods became ends in themselves until their exponents became divorced from the real world of living things. And that in brief has been their history. Each as it arises makes a huge and valuable contribution to learning but never solves all the problems; and with every advance new problems are created or brought to attention.

The advocates of each new fashion or approach to biological problems nearly always assume that what they have worked out and found true for certain plants or animals *must* of necessity be true for all plants or animals.

This does not at all follow; as a case in point consider the following:—It is assumed that the principles of genetics now so widely known and given in all texts are of universal application. That this is not true may be realized if one considers those unique plants called lichens. Unlike ordinary plants such as cabbages or coconut palms a lichen produces no germ plasm and there are no genes; at least no one has ever found any indication of such. Yet lichens have well marked heredity and one can readily trace the evolution of many species. One large group, the Cladonias, seems to be in active evolution here and now.

A lichen is a physiological species, the result of the interaction of a fungus and an alga, but is a very different organism from either, possessing qualities and powers not found in either alga or fungus. A lichen does not produce an ovum which becomes another lichen when fertilized.

Lichens are a challenge to the geneticist. Ever since 1919 in published papers, in lectures, and in private conversation I have urged geneticists to study heredity in lichens, but thus far none have been willing to do so.

For many years I studied fish in the oriental tropics for two reasons. First, just to know about them in their be-

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wildering variety; second, to help increase the main protein food of hungry millions. It did not take long to find out that those in North America and Europe who laid down fixed principles for fish pond culture did not realize that there were fish in the tropics which lived by a different set of principles. It was also soon evident that many salt water fish in the East Indian realm paid no attention to what mathematicians said or to the "experts" who tried to apply knowledge gained in the North Atlantic or Alaska. One can hardly make any statement about plants or animals but what it will be found that there are organisms which refute or contradict his remarks by their lives.

That is why I still believe that the fundamental requisite for a zoologist or botanist (biologist if you prefer), is to know animals and plants in their native habitat. Upon that foundation one may rear whatever superstructure that is needed, or that an active imagination may desire. As for solving problems, no man can expect to solve more than a minute fraction of those before him, any more than he can realize the full scope of problems in the living world.

Mr. Bonner worries because we are not solving tomorrow's problems and proposes that the would-be biologist should become a biochemist. He also proposes that he should become a physicist or a mathematician. By the time a young men has but a master's degree in each of these lines it is not at all likely that he will ever take up the active study of living things. As it takes a good many years to get acquainted with the literature in a special field, I wonder how old Mr. Bonner's biologist would be when he finally took up biological literature? Then he would have the chore of keeping up in chemical, mathematical, and probably other floods of scientific literature in addition to that in biology. With the retiring age foolishly fixed at 65 that would leave him but a few years in which to solve the world's biological problems.

Mr. Bonner seems to say that complex biological problems can only be solved by chemists or biochemists who are also mathematicians or physicists, though engineers are also in the running. If that is true why is he in the division of biology? If he had said "some" complex problems, there could be no objection. But he should recognize that there are many complex problems which cannot be solved by mathematics, chemistry, or physics, and that even engineers cannot solve everything. I have seen too many fail in trying to solve biological problems by such means to accept his unqualified statements. It may be that he believes there are no complex problems in biology except those that respond to the slide rule, test tube, and mathematical theory. I do not believe that any one can say just what method of approach must be taken in the study of living organisms. Dynamic teachers or investigators gain followers and prestige until another arises who takes a different route, perhaps incorporating much of what has gone before. While these pioneers are prone to take but a partial view, their followers in the end always wind up with limited vision.

In the current press "scientist" means chemist or physicist; apparently Mr. Bonner agrees, though much has been published in the AIBS Bulletin against this restricted view. Also in the current press chemists and physicists frequently "sound off" on matters pertaining to biology when it is quite evident that they know nothing of what they are discussing. But to the man in the street "science" has spoken.

Mr. Bonner speaks of "teaching wisdom." I have known a few people who attained wisdom, but know of but one way in which it may be acquired. The open receptive humble mind may be taught wisdom by life itself, and even then it takes many years. We cannot "teach wisdom" in the class room, lecture hall, or laboratory.

It would be a sad day when biology ceased to be changing. Every problem solved creates new ones, and some of them may well be insoluble by finite man. I believe it is unreal to expect to solve all problems, biological or otherwise, either now or in the future, just as it is equally unreal to expect to solve all biological problems purely by mathematics, chemistry, or physics. I say this in spite of the fact that more than fifty years ago we knew that much of what passed for thought in human beings was purely a physicochemical reaction. However such involuntary or subconscious reactions may be short circuited and replaced by a different reaction due to thought, a reaction which the chemist or mathematician may not foretell.

I do not know what Mr. Bonner means by the "sophisticated laws" of biology, nor what "sophisticated instruction" means. I am merely a fisherman naturalist who is also a crytogamic botanist who has been taught by plants and animals all over the world, in fresh and salt water, prairies and forests, deserts and mountains. My greatest single lesson was these words spoken by David Starr Jordan:...."Authority? There is no authority."

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Natural History Museum
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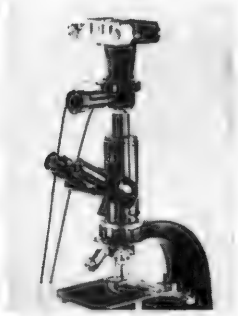

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An address delivered at the 1960 AIBS Meetings at Stillwater, Oklahoma. The author is Immediate Past President of AIBS.

Wallace O. Fenn
University of Rochester Medical Center

Front Seats for Biologists

Introduction

I am much pleased indeed to have this chance to speak to a large and distinguished assembly of biologists concerning biology and the role of AIBS in the scientific life of this country. I did help to found AIBS in 1947 and represented my society at a meeting called by Dr. Bronk to advise the National Academy of Sciences on the desirability of forming such an all-inclusive organization of biologists. I recall also an earlier attempt to accomplish the same purpose, which fizzled out in a few years. This second attempt succeeded almost beyond our wildest dreams. Let us not forget that it was the NAS which founded AIBS and nursed it through its weanling years. Without that initial support AIBS would never have come to pass. On the other hand without the rather drastic act of cutting the umbilical cord which bound AIBS to the NAS, this organization would never have become self-sufficient and would never have been worth the trouble involved in its organization.

Such a separation from NAS was no novel idea. Even at our first meeting, if I remember correctly, we were told by Dr. Bronk that sooner or later AIBS must expect to become self-supporting and independent. In 1954 it became evident to me and to others that the time had arrived when AIBS should strike out for itself and sink or swim as the case might be. It was primarily Bentley Glass and Hiden Cox who made that bold declaration of independence a success. They swam and AIBS did not sink. There was no lack of gratitude to NAS in that move but rather an awareness of the fact that a voluntary association of biologists operated by themselves on a democratic basis could never thrive as a subsidiary of any other organization.

Every scientific society or group of societies must feel full responsibility for everything which it does. It cannot take orders or direction or guidance from any but its own duly elected leaders.

This general principle does and certainly should always apply to the AIBS organization itself. I do not myself regard AIBS as an "umbrella" organization. The member societies do not and should not delegate to AIBS any of their own authority. Every society runs its own affairs quite independently of AIBS. We would not have it otherwise.

AIBS—A Service Organization

AIBS is better described as a Service Organization —service to biology in general and service to member societies. This service is sometimes of a very practical ad hoc type but mostly it is a much more important service of a long range type which brings unanticipated benefits in the more or less distant future. It is the function of AIBS to undertake those services to biology which are of interest to all biological societies but which no one society can do by itself. For this purpose AIBS needs vigorous, wise, imaginative and constructive leadership.

There was a time—let me remind you—when the presidency of AIBS was a thankless chore for some public spirited biologist—it represented a lot of work with very little honor and prestige as a reward. I hope it will always represent a lot of work, but I am sure that it will be a position of increasing honor and prestige. I am very proud to have had the opportunity to serve in that capacity although I am sure I did not deserve it and I regret very much that I was able to do so little to justify my tenure of that high office. The presidency of AIBS should represent the highest position which a biologist could achieve short of perhaps the presidency of the NAS or the American Association for the Advancement of Science which represent all sciences in addition to biology. At the same time this position should not be an empty honor. It is a position for a statesman. AIBS needs as president a distinguished biological scientist who is also expert in scientific affairs and human relations. He must be able to understand the role of biology in the affairs of men and be continuously on the alert for ways in which biology can improve its service to mankind.

In this respect Jim Dickson measures up exceedingly well and is providing very inspiring leadership. He

needs and deserves your support in every possible way. The most direct way in which the member societies can express their support is in the selection of your representatives on the Governing Board. The men whom you select for these important positions should be regarded as your nominees for president of AIBS. The members of the Board have been well chosen in the past and this must be true in the future. If not, AIBS will coast along shuffling papers for a few years and then expire. To survive, AIBS must continue to grow—not necessarily grow in size but grow in importance, influence and prestige. It must accelerate not decelerate; it must pedal not coast; it must row and not drift. Everything it undertakes must be done with utmost perfection, so far as that is humanly possible.

Perhaps equally essential for AIBS is its Executive Director. He is the antenna of the organization, the receptor, the integrator and the effector. It is the Executive Director who makes all the routine day to day quick decisions and who represents AIBS in all its innumerable contacts with the scientific public. In his frequent conversations with Government officials and officers of member societies he will be the first to appreciate the opportunities for service which present themselves and will be able to bring them to the attention of the President. In this respect AIBS is most fortunate in its Hiden Cox and biologists owe him a great debt of gratitude. Let us remember that he gave up a University professorship with all its prestige and emoluments in order to serve biology full time as our Executive Director. In a position which demands delicacy and tact of a high order as well as skillful organization ability he has done a marvelously fine job and I have only unstinted praise and admiration for him. I only hope that in the long run in this position he will find enough compensation and satisfaction to balance the substantial sacrifices which he has made.

The Importance of Biology

But I am supposed to talk about "Front Seats for Biologists"—not a very good title to be sure but good enough to cover what I want to say which is, I must confess, nothing very new.

We are all convinced that Biology is the Queen of the Sciences, although it is often regarded as only a handmaiden, the weakest of the sciences and the least well supported. I want to discuss some of the reasons for this situation as well as the reasons why it is not true. Biology needs no apologies. Finally I want to express my conviction that mankind needs a well-defined reason for living. For what purpose if any are we, intelligent, thinking, reasoning persons, placed in this thin film of air which clings to the surface of this whirling planet? Obviously it is our business to discover the answer if we can—by the ardent pursuit of knowledge and particularly biological knowledge. Therefore from a very long range point of view biological research becomes the highest objective that can be thought of for human life. In this respect the biologists deserve front seats in the halls of learning and the mission of AIBS becomes closely identified with the mission of mankind.

Fractionation of Biology

One of the main reasons why biologists appear to occupy only the back seats rather than the front seats is the fractionation of biology. One group of scientists after another has seceded from biology, and what remains under the strict designation of biology in the public mind is nothing more than some superficial natural science. Agriculture and medicine are both applied biology but neither group admits to belonging to biology and biology gets little or no credit for all their great advances. Anything chemical belongs to the biochemists and anything physical to the biophysicists and neither group admits to being biologists —anyhow they do not belong to AIBS and biology gets no credit. It is indeed hard to beat the biophysicists in this respect. Recently a prominent biophysicist defined for me the limits of his subject. "Anything which has rational explanation," he said "belongs to biophysics and biology can have all the rest of it." Even so, a lot remains.

Even the physiologists (I mean the animal physiologists) are to some extent guilty in this respect although I am proud to say that the American Physiological Society in spite of its strong medical affiliations was the first to join AIBS and is the only society in the Federation of American Societies for Experimental Biology which can claim full membership in AIBS. The physiologists want to be recognized as biologists. Nevertheless they have never joined a meeting of AIBS and animal physiology, at least, is usually reported to the American Physiological Society. The AIBS program suffers in consequence and, more important, the physiologists continue in their narrow specialties without any adequate realization of the magnitude and importance of other biological societies.

No longer does biology cover all the sciences concerned with living organisms and clear evidence of this is the repeated use of the term "life science" in place of biology, especially in military documents. The plain and sad fact is that the term biology inevitably has a very special and limited connotation to the public mind and even to most scientists so that it does not mean the same thing as the expression "the life science." Perhaps AIBS would thrive better under the term AILS—American Institute of Life Sciences. This spells however "ails" and indicates again the sick man of science. Further AIBS means *all in back seats,* and I think it should mean *all in the best seats.*

I do not seriously complain about the fractionation of biology. It is too broad a subject to be covered by any one mind and these specialties are of course a sign of progress. But fractionation makes unification increasingly difficult and it is important that all the biological sciences should belong to AIBS as a sign of their common interest. Without the concerted action of all biologists many economies and accomplishments are beyond our reach.

You have all read Professor Prosser's eloquent case against that insidious Cooper antivivisection bill. Put

80,000 or more biologists individually into that fight in behalf of biological research and the bill would never pass the Senate.

Achievements of Other Sciences

Perhaps the recent brilliant accomplishments of other sciences have also contributed to the relatively backward position now occupied by biology in the public mind. Astronomers can show us marvelous photos of millions of galaxies, thousands and millions of light years away—each galaxy as big as our own, and each containing I suppose millions of stars and solar systems like our own. So man and his troubles and his life processes fade away into insignificance and we are left gazing in awe and wonder at our universe.

Physics has had a revolution and no ordinary biologist like me really understands just what it means. It is much more drastic than the assertion of Copernicus that the universe is heliocentric rather than geocentric. Now the universe has become four-dimensional instead of three dimensional. It is hard to distinguish space from time. Matter can no longer be distinguished from energy. Clocks no longer keep time and one cannot believe what one sees and feels because it all depends upon how fast one is moving. The geometry of space is non-Euclidean and what all this means for biology no one seems able to tell us.

In addition physics and chemistry together have given us all the isotopes and all the 30 fundamental particles out of which matter is composed, the electrons and positrons, the protons and antiprotons, the mesons and hyperons, the neutrons and neutrinos and various others. From all this has come the atom bomb and the hydrogen bomb which carries such a dire threat to the future of humanity.

It is no wonder then that biology has been thrust aside while the world contemplates all these new marvels of the physical sciences. But the wonders of biology are far greater than all these wonders of physics and chemistry. The trouble is perhaps that the phenomena of biology are too familiar to us and familiarity breeds contempt. We have all seen great oaks grow out of acorns, birds hatched out of eggs, and babies born after matrimony. Such is life, they say. Don't expect to understand it—just enjoy it. Living things have their ways. You can describe them in as much detail as you like and that is biology—a descriptive science but not a basic science. Don't ever expect to get to the bottom of the problem. Life was created by God. Possibly man evolved from simpler forms as the fossil records appear to indicate. But the nature of life itself is God's secret and must forever remain beyond our reach. So runs the common argument—and it is perhaps another reason for the back seat status of biologists. For the real fundamentals of biology seem to be the responsibility of the theologians and the philosophers and do not belong in the realm of the experimental sciences. Therefore we might even ask the question whether biology is really a science at all—since we are denied access to the fundamentals of the subject.

Some Reasons for Front Seats

Well, this of course is nonsense and the advances in biology have been as great as in any other science. True it is however that the truly basic aspects of biology seem quite beyond our reach at present—the nature of consciousness for example. What a phenomenon that is compared to the physical world! The eye of the astronomer receives light from a galaxy millions of light years away—an incredible thought. But even more wonderful is the fact that the astronomer is *aware* that he is seeing a distant galaxy. He *knows* where that light came from. The first records of man on earth are only 500,000 years old. Therefore since that ray of light started on its journey there has developed on the earth a conglomeration or organization of atoms and molecules which functions as a whole and is somehow *aware* of its surroundings, and it can think and reason and knows, or believes that it knows, when and where that ray of light set out on its long journey. Even more important, he knows that he knows, and tries to understand the real meaning and mechanism of knowing. He wants to know how he knows and how his brain works.

This problem of consciousness is one which biology has never cracked. No one has the slightest clue or knows how to begin the study. Some believe that only man is conscious because God endowed him with a soul. Others believe that all living things have some sort of consciousness in a primitive form. Still others would argue that the essence of consciousness or the mechanism of consciousness must reside somehow in the molecules of which we are composed. When we know enough about the molecules and the certainties and uncertainties of their arrangements, we will understand consciousness and all the secrets of life. Thus even the stones might be considered to have the elements of a certain sort of inherent molecular consciousness.

This indeed must be the official Russian belief because the Party seems to think that it has discovered dialectical materialism and seems to have decreed that this point of view must determine the beliefs and activities of all loyal Russian scientists, who must join together to battle the silly idealism or dualism of the effete capitalistic West. Dictatorial control of scientific thought by politicians has never proved successful and never will. In the free countries of the world the scientists will keep an open mind. Dialectical materialism is a good theory to work on in science, but it is only a theory. As regards the problem of consciousness it just might be that the human brain is too simple a structure to comprehend such difficult matters as consciousness and the soul. Man may never know how he knows. Alfred Noyes described a man very perceptively and objectively as

> "Salt and water held together
> To tread the dust and stand the weather."

I might describe the human brain similarly as

A salt and water aggregate
To think and know and cogitate.

According to Dr. George Corner the brain was described by Robert Boyle as differing very little in appearance from "so much custard." It is not hard to believe that it might have its limitations. A delightful book called *Flatland* by E. A. Abbott published about 1880 described how the people of Flatland, brought up as they were in a strictly two-dimensional space, were quite unable to comprehend anything about three-dimensional space. One citizen who somehow escaped temporarily to three-dimensional space and tried to explain the concepts on his return was jailed for life for subversive activities. Similarly we must be prepared for the possibility that the human brain will never be able to understand itself, or consciousness or perhaps the nature of life itself. If so there may indeed be a truly impenetrable barrier ahead of us in biology and the theory of dialectical materialism will be disproved. Anyhow in our pride of man's intellectual accomplishments, let us be humble enough to admit that we are mortals and not necessarily infallible and potentially omniscient. But let us keep trying nevertheless, and perhaps continued evolution will produce men with four- or five-dimensional brains which will be adequate to cope with this problem in the next half-million years.

Biology is still making rapid progress, and it is even now experiencing a revolution which may turn out to be as dramatic as the revolution in physics. The advances in nucleic acid chemistry have greatly illuminated the structure of genes and chromosomes to such a degree that growth and development and inheritance of parental characteristics become almost understandable. Viruses can almost be synthesized in the laboratory. Several reasonable explanations for the origin of life have been offered. The modern biology department is not complete without someone who knows biochemistry and biophysics and mathematics and is exploring fundamental problems of cell function. Modern biology is a dynamic analytical science and not merely descriptive. Much of this modern spirit is being introduced into the teaching of biology in schools and colleges and AIBS with its teaching film series and Curriculum Study is playing a most important role in the process.

In the advance of civilization biology has a great role to play, in medicine and agriculture, in the ocean and out in space. From the ocean may come food for man and out in space, we know not what, but anyway food for thought. The solution of the photosynthesis problem would revolutionize human life as much as the development of a practical device for using the energy of nuclear fusion for peaceful purposes. A big crash photosynthesis program comparable to the cancer program might well pay big dividends in 10–20 years and, incidentally, if successful it would not only contribute to human nutrition but would solve the problem of pilot maintenance during space travel. As biologists we have a right to be proud of our science, and we want AIBS to tell the world about it, and we see no reason for being content with back seats.

There are other reasons for front seats, and in this connection I have the temerity to speak about biology in its relation to religion for they are in a sense contiguous subjects, religion being defined as an interpretation, perhaps an emotional interpretation, of those problems of life to which biological science has not yet been able to provide any reasonable answers.

As a college student I almost followed my father into the liberal ministry before I began my scientific career in physiology. I have therefore a great respect for religion which supplies some meaning and purpose to life for many people. Even so, as biologists, most of us would be happy to have more facts and less imagination for our religious guidance. Now certainly it may be that there *is no* meaning to life and man may be just a chemical accident of the environment under the impact of radiant energy from the sun. Even so, here we are, and we had better find some meaning or invent one for ourselves so that we have some definite mission to lend dignity to our life. If there is a meaning, it obviously lies somewhere in the vast areas of biology which are still unknown to us, and we should have faith that it is at least worth looking for by the usual rational experimental approach. In such a search all the sciences contribute, but it is the biologist who applies the new developments in science to the problem and who is therefore the spearhead of the attack. We do not yet know where we came from, where we are going to, or why we were here or what life is all about. We are however blessed with truly remarkable brains, and it behooves us to use them to the limits of their capacity to find out all we can about whatever there is that might be defined as God's purpose. This effort *per se* seems to me to satisfy man's yearning for a purpose or mission in life. This is a sort of religion which places the emphasis on striving rather than arriving. It might be described as pantheism or just agnosticism coupled with a determination to find out —or perhaps "biologism." Unlike the physical sciences biology can be almost a religion in itself.

Thoughts on a National Purpose

But let us take a look now at this problem from a national point of view. I do not know the mission of the USSR, but it would appear to be to become militarily or at least economically strong enough to overtake and surpass the USA, by peaceful coexistence we hope, but by any other means that may seem necessary, to the end that Communism may dominate the earth. With time enough and the obligatory dedication of all the efforts of the whole population to this one end, it is hard to see how they could fail, unless something unforeseen intervenes or unless the USA responds with some comparable effort. What then is the main objective of the USA? I doubt whether there is any unanimity on this subject, but as given in the Declaration of Independence it is apparently "life, liberty and the pursuit of happiness." In this country many of us do seem to be looking forward to a 30-hour work week, the rest of the time being spent in looking at atrocious TV shows, listening to advertising plugs or dashing madly about trying to enjoy ourselves. However much this may appeal as

an immediate goal to the average U.S. citizen (and certainly it has little appeal to hard working biologists), it is not a sufficiently serious or dignified life purpose for mankind or the nation; it is only a selfish play-boy philosophy of life. In spite of a regrettable amount of poverty in this country we do appear to be on the whole an affluent nation with all its attendant dangers. Everyone is free to make his own living in any way he pleases, within the law, and there is no central authority to decree which jobs are important, and which consumer goods are necessary and which are unnecessary or which scientific problems should be emphasized for the overall objective.

In the USA much time of skilled engineers is spent in making better automobiles, cameras or refrigerators while in Russia they simply copy our models which are considered good enough for their purposes and concentrate the efforts of their engineers on rockets. We waste enormous efforts in advertising and intramural competition almost none of which exists in Russia where the corresponding man power can be devoted to Communist propaganda. In the USA someone had to design and build lawn mowers for almost every home while in Russia otherwise useless man power or woman power is used to mow the lawns in the public parks with hand scythes. Lawn mowers and perhaps private lawns seem to be considered unnecessary for the national purpose. Most of our vast automobile industry and most of the occupations that depend upon automobiles do not exist in Russia and the enormous man power thus released can be drafted for more essential work.

Happiness suggests wine, women and song. We have all three and so do the Russians, but in Russia the women are found hard at work with the men in every kind of job and are seldom displayed with or without their finery, as a diversion from the serious business of getting on with the job. Sex is not so obvious or so much exploited commercially in Russia as it is in the USA. Such is the general and rather terrifying pattern of the tremendous concentration of effort in the Soviet Union. In many respects it would be all very fine if it were not all done just to gain supremacy over the USA with its happy laissez-faire system which has served us so well in the past. Well, we do seem to be ahead of the Russians in the beauty and charm of our women but I am afraid this has little survival value for us.

I am glad to say that we also seem to be still ahead of the Russians in biology but even here we must look to our laurels. The Russians are avid readers and they pursue the acquisition of knowledge with admirable diligence and enthusiasm and consider studying one of the best jobs open to them and that of course is why they have so many students—they are all state employees. In this respect we are improving but if we have no better mission in life than the pursuit of happiness (superficially defined), then we are indeed doomed as a nation. To be sure it would be a noble and an impossibly difficult undertaking just to supply freedom and happiness to all the people of the world. But this would be at best only a negative accomplishment; it is freedom *from* totalitarian domination and freedom *from* famine, disease, and war. These are all vital negative requirements for any purpose, but when that is done, what then? Is there not something positive still to be done? I suggest that our mission should be rather "life, liberty, happiness and the pursuit of knowledge —particularly biological knowledge." Thus, life, liberty and happiness becomes a means to an end and that end is to push back the boundaries of knowledge in all fields until perchance some centuries hence we can find out what life is and why we are here. Everything we learn in the process will certainly be of great practical value and perhaps even of survival value.

To summarize this comparison of the USA and the USSR, we might ask the Russians of what value it is to gain the whole world if you lose liberty and happiness in the process. And we might ask ourselves —of what value is a life of liberty and happiness if in the process you contribute nothing of lasting value to the world.

Obviously both nations could join to their mutual advantage in the pursuit of knowledge but only if primary emphasis on other goals can be given up. In this comparison I have of course defined happiness very narrowly and made us out much worse than we are in order to drive home a point, but self-criticism is good for the soul, and no one is quite as bad as his philosophy might suggest—not even those fine serious-minded Russian people who have been so friendly to those of us who have visited their country.

More Knowledge—Our First Objective

The attainment of more knowledge of the universe and of life in all its aspects might be then our first objective but it is also our prime means of defense against the loss of life, liberty and happiness as a result of totalitarian domination. For science is the very basis of modern military defense. Try as I may I have been unable to think of any more dignified or more satisfying statement of the objective life than just this. And in this statement I find another reason why biologists should occupy front seats in the halls of learning for the knowledge which is of the most importance to us in peace, and of no mean importance in war, is the knowledge of life and of man.

In the pursuit of this goal the primary need is more and better education not only in biology, not only in science, but in all the learned professions. There are however some jobs which are more important than others; there are some which are useless for the overall mission and some which are of negative value. Just because a particular job will earn a living—perhaps by enough skillful advertising—is no reason why it should be done. Some central direction of the activities of our citizens may be necessary just for survival. But if this is done by majority approval, by a duly elected Nixon or Kennedy, and if we do not lose our right to "vote the rascals out" every four years, then I see no serious danger of becoming a police state and I should have to give a reluctant consent. Anyhow we must somehow devote more money and effort to the really important tasks. Without some well defined mission and some long range planning our national survival hangs by a tenuous thread. The AIBS is in good position to assist in the formulation and execu-

tion of a five-year plan for science and biology which requires mostly more and better education, more motivation for education and less waste of effort in unworthy activities.

Summary

In AIBS we have at last an organization which can make long range plans for biology, which is for mankind in the last analysis, the most important of all the sciences.

Just for his own individual peace of mind—for his religion—man needs a mission in life and this could well be the pursuit of knowledge, particularly biological knowledge, to find out why we are here.

For national survival we are also in desperate need of a worthy mission with survival value and this also must depend upon more knowledge about the physical world, and about life, about ourselves, our brains, and our social behaviour. We must be able to control the forces which the physicists have unleashed for us. We have to know the truth and the truth will make us free.

So, my friends, any way I look at it, I find the biologists have as good a right to the front seats as any. Give AIBS your support and let AIBS help you not to be too bashful about taking possession of those seats.

And finally, if the biologists occupy those seats they must continue to deserve them by their contributions to knowledge. A physicist needs to know only physics but the biologist at the peak of the scientific pyramid must know enough of all the sciences for his proper orientation. This he has not always done in the past and *this is the great challenge to Biology and to the AIBS.*

. . . . AN ANNOTATED

Bibliography of Influenza

Vol. I, No. 1, 1960

THIS PUBLICATION is a bibliographical record of articles published on influenza and related subjects in periodicals in the United States and abroad. Approximately 2600 available journals are being searched in this project.

The original plan of the NIH and the AIBS, in the preparation and publication of this bibliography, was to begin Volume I, Number 1, as of January 1, 1960. Unforeseen delays made this schedule impossible. We are, therefore, beginning with this issue. References cited prior to June 1, 1960 will be included in a separate volume, soon to be published, which will contain all references on this subject for the period, January 1, 1957 through May 31, 1960.

There will be only two numbers of Volume I. Volume II, beginning with January 1, 1961, will contain four numbers. The last issue of each year will contain a subject and author index to the references cited for the entire year.

Each issue of this bibliography is divided into the following major categories: General and Review, Epidemiology, Clinical, Pathology, Prophylaxis, Immunology, Virology, Animal Studies.

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The Indiana University Institute for Teachers of High School Biology—an approach to teacher education

Shelby D. Gerking and Paul E. Klinge
Indiana University, Bloomington

Teaching the Teachers

Introduction

The National Science Foundation Summer Institute Program brings teachers together for short, concentrated periods of study in order to increase their competence in the subject matter of science. We are chiefly concerned here with Institutes for high school teachers and with biology in particular. This is the first time that such a device has been used on a national scale, and for this reason the program has been largely experimental. Two major types of Institutes have evolved during the last six years: one in which several sciences are taught and the other which is devoted to a particular science. Less than 10 per cent of the Institutes have been devoted exclusively to teachers of high school biology. In view of the importance of biology in the high school curriculum, more Institutes of this type are needed. Our own experience has been so rewarding for both the teachers and the faculty that we would like to encourage other biologists to initiate similar programs of their own.

The NSF Summer Institute Program started with one experimental series of lectures in biology held at the University of Oklahoma in 1953 and has grown to more than 381 Institutes in 1960. All the major fields of science are represented, and institutions throughout the continental United States, Hawaii, Alaska, and Puerto Rico are participating. In 1957, there were 5 of a total of 95 Summer Institutes devoted exclusively to high school biology teachers; in 1958 there were 3 of 108; in 1959 there were 22 of 350; and in 1960, 26 of 381. The statistics do not reflect all the biology teaching being done, however. Several Radiation Biology Institutes, jointly sponsored by the Atomic Energy Commission and the National Science Foundation, have been organized each year. Seventeen, the maximum number, were held in 1959 and 1960. Also, many Summer Institutes offer courses in several fields of science, and biology is one that is usually included.

We believe, however, that biology teachers can be stimulated and their knowledge deepened more effectively if they attend a summer program especially tailored for them in the field of their greatest interest. In order to support this viewpoint, we will describe our concept of an Institute as it has developed at Indiana University from 1956 to 1960, together with a background of a few historical cases from which it has grown. We do not wish, however, to leave the impression that ours is the ultimate solution to the problem of teaching the teachers. On the contrary, it can be accomplished successfully in a variety of ways, and our program is only one.

Historical Development

The rush to help alleviate the present manpower shortage in science and to awaken the public to a realization of the importance of basic science in modern living tends to obscure the fact that similar educational crises were met in earlier days with many of the same techniques that have now been adopted. The Institute idea is not a new one. Three famous examples are submitted here to show that short, concentrated periods of study have been used effectively as a method of improving the quality of teaching in the past. These experiments provide valuable lessons that may be applied to the present program.

The term "Institute," in its present connotation, was coined by Henry Barnard, a pioneer New England educator. In his efforts to improve the school systems and the quality of teaching, he advocated short, concentrated, "Teacher Institutes." The first one was held in 1839 in Hartford, Connecticut, by Mr. Barnard, and a number of educators acted as the faculty. Teachers were instructed in grammar, "mental and practical" arithmetic, higher mathematics, reading, composition, "instruction of very young children by means of the slate," mathematical and astronomical geography, and several lessons on the methods of teaching and school government. In those days there was no system of normal schools or teacher licensing, and the "Teacher Institute" was probably the only instruction teachers received that was directed toward the problems of their profession.

As these groups developed, they became "In-service Institutes" similar to some now being attempted by the National Science Foundation. Between 1845 and 1860, the Commonwealth of Massachusetts supported 160 Teacher Institutes lasting from 5 to 10 days and financed the teachers' expenses. In the list of ". . . certain gentlemen of eminent ability in their respective branches of instruction," appears the name of "Louis Agassiz in Natural History." Knowing Agassiz and perusing the list of subjects taught, it is obvious that the Massachusetts Teacher Institutes concentrated on the presentation of subject-matter.

To present the story chronologically, we turn to education in England. In the early nineteenth century, English gentlemen in private schools and universities were being educated for the most part in the purely classical tradition—no science, mathematics, or modern language. By 1860 the clamor by an expanding class of landholders for a more modern curriculum became so great that a Royal Commission was established to investigate the situation. About this time Thomas Henry Huxley strode on the scene with his characteristic vigor and enthusiasm. He influenced science education in two ways. During an elected tenure on the London School Board starting in 1870, he argued for a more practical system of education, a system that is still used today. He also carried his mission to the classroom. In June and July, 1871, he gave a series of 36 lectures on biology to a group of schoolmasters. This was the first "Biology Institute." Huxley expressed his enthusiasm in a letter to Dohrn near the end of the course in this way, "He (E. Ray Lankester) is helping me as Demonstrator in a course of instruction in Biology which I am giving to schoolmasters—with the view of converting them into scientific missionaries to convert the Christian heathens of these islands to the true faith" (L. Huxley, 1902).

This course was given in the Royal School of Mines, Huxley's home institution. The next year the School was moved to new quarters in South Kensington, another section of London. Here he had laboratory facilities for his teaching. They were used for the first time during a second "Institute" in 1872. Huxley lectured from 10:00 to 11:00 a.m. each day for six weeks, and each lecture was followed by a four-hour laboratory devoted to a study of a "type" plant or animal. How little many of us have changed in 90 years! The laboratory approach to teaching was so successful that he adopted it for all of his courses thereafter. According to one authority (Jeffrey Parker) the origin of the biological laboratory in teaching stemmed from these Institute classes in the School of Mines. Unfortunately, Huxley's participation in the Institute was ended after but two years due to reasons of health.

Huxley's efforts to improve biological science education in England were paralleled by those of Agassiz in the United States. Agassiz's admonition to "study nature, not books," is a reflection of the importance he attached to laboratory observation. Even in the Massachusetts Teacher Institutes he did the best he could to place knowledge of the organism first and "book learning" second. In a Ladies Seminary group he first supplied each teacher with a preserved grasshopper and then probably waited until the screams subsided before beginning his lecture. The power of observation of his advanced students at Harvard was first tested on specimens alone, without the help of teacher or books, before Agassiz would allow them to work for an advanced degree with him.

This was essentially Agassiz's approach to teaching at his biological station on Penikese Island off the coast of Massachusetts, an Institute in our context. The Anderson School of Natural History was a gift of a tobacco merchant from New York named Anderson who had heard of Agassiz's plea to the Massachusetts Legislature for an outdoor, summer teaching laboratory. Teachers in the secondary schools were contacted, and they responded for entrance beyond Agassiz's fondest expectation. Forty-four were selected, and they enjoyed one of the unique educational experiences of our time. Agassiz's "Institute" teaching paid rich dividends. From this group came William Brooks (Johns Hopkins), Charles Whitman (University of Chicago, Woods Hole), Charles Minot (Harvard), and David Starr Jordan (Indiana, Stanford). All were high school teachers at that period of their lives, and Agassiz's tutelage helped them become outstanding biologists at the turn of the century.

Agassiz died in 1873, the year Penikese was operated for the first time. His son, Alexander, attempted to carry on the next year, but without the master's touch, the project withered.

The Indiana University Institute for Teachers of High School Biology

Our first attempts to formulate the program in 1955 borrowed some ideas from past attempts to improve secondary education in biology. Our plans proceeded when financial support from the National Science Foundation became available to subsidize the teachers' expenses (Massachusetts Teacher Institute). Also, we decided that attention should be concentrated on subject matter (Huxley and Agassiz); that the course should be taught with a laboratory (Huxley); and that the objective could be accomplished in a summer six-week period (Huxley).

Four years of experience have proven to our satisfaction that these approaches to the problem of teaching the teachers are sound. We have departed in some respects from the Agassiz axiom of "study nature, not books," because that method is better adapted to the potential research person than to the high school teacher. Instead, we have emphasized the use of the Biology Library for browsing and for special readings. Huxley's "type specimen" laboratory was an innovation in his day, but significant changes in biology require a more modern approach to the teaching laboratory.

Our most persistent problem was how to orient the course of study. The decision to stress the dependence of biology on physics and chemistry was based on the selection of participants from applicants who had been away from formal schooling for approximately ten years. Although biology had felt the impact of the physical sciences far earlier than 10 years ago, events have moved rapidly in this direction since then.

Teachers who did not have close contact with university teaching and research may not have recognized the degree to which biology relies on these fields. A similar approach to the teaching of ninth and tenth grade biology could hardly be used, we realized. Nevertheless, the teacher should be conversant with trends in modern biological thinking, if for no other reason than to prepare and advise the exceptional student who may choose a professional career in biology. If the high school is to get this viewpoint across, it could offer an advanced, elective course in the senior year.

Basic Program

The program was implemented by choosing fields of study that were represented in the Indiana University Departments of Zoology, Botany, and Bacteriology. No attempt was made to cover all areas of biology but only those which the departments were best equipped to handle from the standpoint of physical facilities and staff.

One week was spent on each of six topics. The 1956 Institute included Plant Physiology, Bacteriology, Growth and Reproduction, Protozoology, and Ecology. Subsequent programs have altered this pattern by substituting Genetics, Plant Taxonomy, and Endocrinology for one of the above topics from time to time. A lecture-discussion period was held in the morning and a two-hour laboratory or field trip in the afternoon.

A typical week's course of lectures included one or two days on basic, elementary concepts, followed by a series on topics of current interest in the field. The initial lectures were used to review knowledge previously acquired or to introduce the subject to participants who had received little or no training in the particular area. Subsequent lectures were chosen from a series of topics where knowledge is expanding rapidly. Radiation Effects on Genetic Materials, Neural Control of the Hypophysis, Modern Interpretation of Photosynthesis, and Nutritional Requirements of Protozoa are samples of this type. By following this approach, the participants have been led gradually into areas where advances in research are bringing new concepts into biology, some of which can be incorporated into teaching, or used in counseling the academically talented student who is prepared for more advanced ideas.

A great deal of emphasis has been placed on laboratory and field study. The exercises have been planned carefully to illustrate basic principles by providing experiments or observations that are likely to be different from those that the teachers have encountered in previous course work. Wherever possible, the techniques employed in the laboratory are those currently used in research, and the work is integrated with the course of lectures. There has been no concerted effort to design the laboratory exercises to fit the high school classroom. We feel that the adaptation of the laboratory to high school teaching should be the responsibility of the teacher who is better equipped to evaluate his own teaching situation than is our faculty. Through correspondence with our participants, we have learned that some of these ideas are now at work in the high school laboratory or are being used as a basis for student projects.

Far too little laboratory or field work is evidently being done in the high schools. The handling of plants and animals does more to excite youngsters than translating abstract ideas from a textbook. Therefore, we have continually encouraged our participants to conduct a formal laboratory in conjunction with courses that they give in high school. Each teacher has been required to submit a unit of laboratory work that could be used in his courses. These have varied from a single, well-presented exercise to an entire unit of work consisting of several laboratory exercises or field trips on subjects such as bacteriology, ecology, genetics, or plant taxonomy.

Lack of time, space, and facilities frequently discourage high school laboratory work. Our impression is that space and equipment problems are being overcome at an accelerated pace during this period of increased school construction and greater emphasis on science in the curriculum. Time still remains the science teacher's greatest problem. Some teachers are realizing that the laboratory period may be of more value than the accustomed discussion period and are consequently emphasizing more practical experience and less talk in their classes. A biology teacher requires sufficient time to gather specimens and equipment for the classroom or to select areas for field study. In our opinion, time should be provided for this work during the class day. Students will appreciate a well-planned, well-executed laboratory period or field trip.

Special Features of the Institute

Up to this point we have described only the basic program of the Institute. The teachers have a great desire to visit research laboratories, to hear about current research problems, and to learn how they are being attacked. Therefore, arrangements were made to visit experimental gardens, the animal house, greenhouse, X-ray rooms, the electron microscope installation, and the personal research areas of many of the faculty. In addition, one special meeting was held each week during which a member of the staff reported on his research and on current ideas in his field.

Reading was encouraged by several devices. At the beginning of the Institute the teachers were supplied with a bibliography of current books, texts, manuals, and identification keys which they might find useful for reference or for purchase for their school library. Publishers supplied selected texts and other materials from their current lists. Each instructor provided a specific bibliography for the week's work. Stack permits were issued so that the teachers could browse and read at their leisure in the Biology Library. A set of the AAAS Traveling Library books was borrowed each summer and became an outstanding feature of the program.

A "teaching problem session" was organized as a part of the initial Institute in 1956. The participants were assigned to committees that discussed problems concerning curriculum, examinations, the superior student, student projects, etc. These committees then reported to the whole group at a later time. It soon

became apparent to us on the sidelines that these discussions were rehashing age-old problems that have no definite solution and probably should not be solved in a stereotyped manner under any conditions. It was also obvious that informal "bull sessions" in the dormitory where the teachers were housed were accomplishing more to exchange ideas and teaching methods than were our scheduled sessions. Comments from the participants bore out these impressions. They rated our feeble attempt to inject "methods" into our program as the poorest offering of the Institute. In subsequent years a specific teaching problem, new textbooks, or a variety of laboratory materials have been discussed once each week by someone especially qualified for the purpose. This arrangement seems to be much more satisfactory.

One of the great benefits an Institute has to offer is bringing teachers together to discuss common problems among themselves. Enthusiastic discussion was carried on during the entire six weeks. Some teachers caught the spark of enthusiasm from others and went home benefiting from this part of the Institute more than from the formal presentation.

We have employed no rigid set of criteria in the selection of participants. However, a varied science background was the most important criterion used in choosing our group. Those with little knowledge of chemistry would not profit very much from our program. Generally, each participant had taken the basic courses in chemistry and had received some training in either mathematics or physics. Teachers from Indiana and surrounding states were often given preference in the selection since one of our objectives has been to improve biology teaching in our part of the country. The ratio of men to women was determined by their proportion among the applicants. Age was generally not an important factor in selection. The participants have ranged from 28 to 58, but the average person has been away from academic life about ten years. On occasion the budget has been the determining factor in selection. The Institute has been limited to 40 teachers because that was the maximum number that could be handled conveniently in the laboratory and on field trips.

Our job as directors has been to "keep the ball rolling." One of us provided the instructors with laboratory supplies and mimeographed materials, rearranged dormitory space if required, scheduled special events, paid the bills, and saw that immediate attention was given to broken legs, sprained ankles, poison ivy, and virus pneumonia. Our colleagues have commented jestingly that we have been loafing on the job after having seen us entertain visiting firemen, chat with the participants, attend picnics, and visit the lectures. Strange to say, no one has offered to write brochures, mail application forms, calculate stipends, select 40 participants from 400 applicants, schedule picnics, and mend volley-ball nets.

It has probably become apparent that the program we have described is not an ordinary summer school course. There is considerably more flexibility and leisure time for the participants than in a full load of courses. This reflects the fact that the staff has regarded the teachers as adult, professional educators and has treated them as such. After all, high school biology teachers are as interested and dedicated to teaching their students as are college and university teachers. The choice of subject matter and the method of presenting it has been geared to encourage a feeling among the participants that they are privileged to study in an intellectual environment.

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AIBS ANNUAL MEETING — 1961

PURDUE UNIVERSITY, August 27 - 31

The following societies have, to date, indicated that they will meet under AIBS auspices.

AMERICAN BRYOLOGICAL SOCIETY
AMERICAN FERN SOCIETY
AMERICAN FISHERIES SOCIETY
AMERICAN MICROSCOPICAL SOCIETY
AMERICAN SOCIETY FOR HORTICULTURAL SCIENCE
AMERICAN SOCIETY OF LIMNOLOGY & OCEANOGRAPHY
AMERICAN SOCIETY OF PARASITOLOGISTS
AMERICAN SOCIETY OF PLANT PHYSIOLOGISTS
AMERICAN SOCIETY OF PLANT TAXONOMISTS
AMERICAN SOCIETY OF ZOOLOGISTS
BIOMETRIC SOCIETY (ENAR)
BOTANICAL SOCIETY OF AMERICA
ECOLOGICAL SOCIETY OF AMERICA
MYCOLOGICAL SOCIETY OF AMERICA
NATURE CONSERVANCY
PHYCOLOGICAL SOCIETY OF AMERICA
SOCIETY FOR INDUSTRIAL MICROBIOLOGY
TOMATO GENETICS COOPERATIVE

An essential tool for the study and understanding of aquatic sciences throughout the world

Donald P. de Sylva

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Foreign Languages and the Aquatic Sciences

RECENT BOOKS by Conant (4) and Rickover (8) have stressed the need for improved education at the high school level. These and other treatises have recommended earlier and more comprehensive teaching of sciences, mathematics, and foreign languages. While it is agreed by competent educators and scientists that the first two fields are basic to the development of intellectual mastery of a scientific vocation, there has been less said about the value of foreign language training as a "tool" which can be utilized to understand scientific, as well as cultural, progress in other countries. For example, mathematics, the "queen" of sciences, and certainly one of the most valuable single disciplines for a scientist to study, is one of these "tools" and surely there is no argument against the teaching of mathematics as basic to all fields of scientific endeavor. But foreign languages are in their own way just as important to the scientist, for he must be able to evaluate the results of colleagues in many foreign lands if he is to carry on his own research successfully and without duplication (1).

This brief article does not purport to review in detail the need, application and pure academic values of foreign language training. Rather, it is hoped that it will serve as a rough guide to students entering the study of aquatic science in their choice of one or more foreign languages. It seems axiomatic that a scientist be thoroughly trained in at least one foreign language (9), and the writer feels that, after other basic and advanced courses are completed, foreign language study may be profitably increased to the point where a serious student facile in learning languages can never learn too many languages for scientific use.

Languages for Scientific Thought

Although great language complexes such as Russian, Chinese and Indian, with their many dialects, are widespread, English has certainly become the "international language" and remains the most commonly used language for communication of scientific and cultural thought. It is noteworthy that in Japan and India, articles are commonly written in English, while in the Soviet Union and its satellite countries which formerly published many articles in English, French or German, recent nationalism and political movements have caused more and more articles to be printed in the language native to that country. This is particularly true in the aquatic sciences.

Perhaps the simplest way to indicate the extent of research in the aquatic sciences in foreign countries, as reflected in the publications of these countries, is to present the relative frequency of appearance of these articles. Two 1958 issues of the monthly "Current Bibliography of Aquatic Science and Fisheries" were selected at random (5). The occurrence of articles written in various foreign languages was tabulated as a rough index of the frequency with which they occur in print, since coverage of *all* articles is extremely difficult. This monthly report abstracts a high percentage of articles written in all countries dealing with marine and freshwater biology, and other sciences pertaining to the study of the aquatic environment. The languages in which 1500 of these articles were written are given below, together with their frequency of occurrence:

Language	*Occurrence*	*Language*	*Occurrence*
English	989	Finnish	7
Russian	167	Turkish	7
German	98	Polish	5
French	73	Dutch	3
Japanese	73	Chinese	3
Rumanian	20	Yugoslavian	3
Spanish	13	Swedish	2
Italian	12	Portuguese	2
Danish	11	Czechoslovakian	1
Norwegian	10	Indonesian	1

Of the 20 languages represented, nearly 66 per cent of the articles were written in English, and about 11 per cent in Russian. German language articles totaled 6.5 per cent; French and Japanese articles totaled 4.9 per cent each. These five languages represented approximately 93 per cent of all the articles. It is

important to note that of the great scientific languages of the world, German and French have now been superceded in occurrence by Russian, and both are shadowed closely by Japanese. In an analysis of the distribution of the systematic literature of polychaetous annelids by country and by language, Reish (7) found that Russian language papers had become increasingly numerous in recent years, being outnumbered by English, French and German during the 1950-1954 period. At one time an English-speaking scientist could keep up with most of the world's literature by knowing French and German, yet he now is missing many important contributions in the marine sciences if he does not pay close attention to Russian and Japanese. A recent report by the National Science Foundation (6) states this problem very succinctly by showing that 30 per cent of the world's scientific literature is produced in languages read by less than 5 per cent of American scientists. This shift in emphasis over a period of time from one language to another indicates that what may be a relatively unimportant scientific and cultural language today may be a dominant language in certain fields tomorrow. For example, Chinese, which ranked quite low in the sample, and Arabic, which did not occur at all, may be "must" languages for the future scientist.

Of value to the young scientists who are perplexed at the languages from which to choose among these 20 is the fact that all but three—Indonesian, Turkish and Finnish—belong to great language families which are better known to many: Romance, Teutonic and Slavonic. Japanese, which has yet to be connected with larger language groups, fortunately is often taught in American colleges. The classification of most of these languages into Romance, Teutonic and Slavonic groups permits the interested student, once having mastered a representative language of these groups, to push on with less difficulty and to learn closely related languages belonging to the same group (2). Thus, a student or researcher who has mastered French grammar and vocabulary can learn enough fundamental Italian, Spanish or Portuguese to read at least titles or abstracts of articles in his field. In spite of the virtual absence of Latin or Greek today as a means of scientific communication, the roots of these once important languages facilitate the learning of many foreign languages, and although they may be considered "dead," the research scientist can more often than not benefit from a knowledge of Latin or Greek.

Scientific Literature Translation

Currently there is much talk about machine translation of foreign languages, and how, eventually, all languages will be available to the non-linguist at the flick of an electronic switch. While such techniques may one day be helpful, it is doubtful that all works in all fields of scientific endeavor in all languages will be translated. Even if this costly method were available to the average scientist, the increasing flood of scientific journals, now estimated at 50,000 annually (3), would require translation to be limited to current publications, thus neglecting the horde of valuable data in many languages which now gathers dust in countless library stacks. Furthermore, machine translations can never replace the scientist's own translation of a particular phrase in his own specialization. Although commercial services today will prepare a literal translation of an article for about $20 per 1000 words, it is impossible to obtain enough qualified translators who can tackle both English and the foreign language, *as well as* the scientific specialty. Even then, it is assumed that the scientist, in order to have his article translated by a commercial service, must have had some familiarity with that language to locate the article in the first place, unless he resorts to abstracting services which are still incomplete despite the tremendous efforts being made to increase the coverage.

Importance of Language Knowledge

Thus, there is no easy way out if one is to expand continually in one's search for knowledge. For knowledge knows no political boundaries, nor does scientific cooperation between countries cease merely because of different ideologies between two political regimes. In aquatic science, this is particularly true, as the seas, and often fresh waters, are truly international, and in the North Sea, for example, a dozen different nations may fish in and conduct research in the same area. Perhaps future scientists in the field of aquatic science will recognize the philosophy of Cervantes' remark that "One language makes a wall; two are needed to make a gate."

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Basic research to be undertaken by Asian scientists under the auspices of the Philippine Government, Ford and Rockefeller Foundations

J. G. Harrar
Vice President, The Rockefeller Foundation

International Rice Research Institute

ON A TRACT of nearly 300 acres at Los Banos in the Philippines, work is currently under way on roads, bridges, and irrigation and drainage systems in preparation of the site for the new International Rice Research Institute. Construction of buildings will begin soon. The Institute, a cooperative venture of The Rockefeller and Ford Foundations with the Government of the Philippines, is planned as an International center for research, training, and dissemination of information on the world's major food crop.

At the Institute a staff of about 20 senior scientists will conduct basic research on the rice plant, on all phases of rice production, management, distribution, and utilization for the nutritive and economic advantage of the people of Asia and other countries where rice is the staple of the daily diet. They will also publish and disseminate research findings, distribute improved plant materials to other research centers for use in plant breeding and improvement, and maintain an information center and library containing a collection of the world's literature on rice for interested scientists everywhere. Periodic conferences — international, regional, and local—will be sponsored by the Institute for the discussion of rice problems.

The staff scientists, in addition to conducting and directing research projects, will devote a substantial portion of their time to a residency training program. Promising younger scientists chosen from all the rice-producing countries of the world will be brought to the Institute for experience and study under the guidance of its distinguished scientists. Upon completion of their training it is expected that they will return to their own countries to participate in local rice improvement efforts.

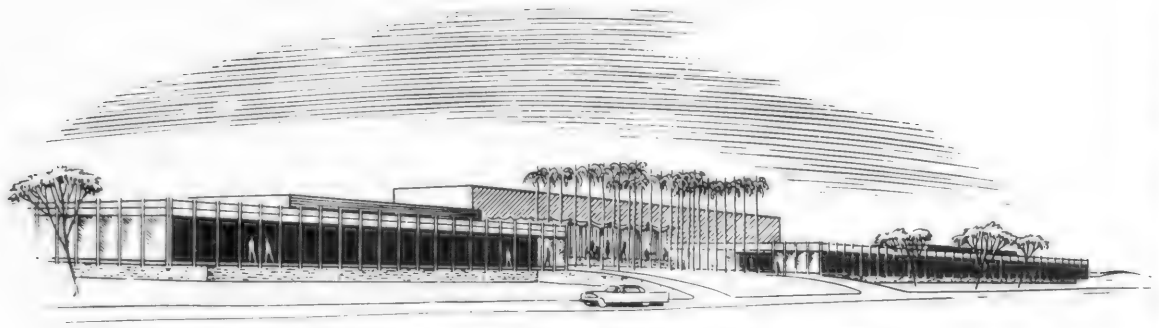
The Rockefeller Foundation will provide an operating budget for the Institute and be responsible for the direction of its program. The Rockefeller trustees have thus far appropriated $185,000 for preliminary expenses and for the 1960 operating costs.

The Ford Foundation is assuming the capital costs of the Institute. The Ford trustees have appropriated $6.9 million for buildings and equipment in addition to $250,000 voted last year for planning expenses. The Government of the Philippines has contributed a substantial amount of acreage adjacent to the College of Agriculture of the University of the Philippines, and is affording tax and duty exemption to the Institute as well as resident status for its foreign staff and students.

The mode of operation of the Institute is to follow the general pattern developed over 17 years by The Rockefeller Foundation in its operating programs in Mexico, Colombia, Chile, and India. In these countries, in cooperation with the national ministries of agriculture, the Foundation's resident staff led research projects to increase the quantity and quality of basic food crops, and direct the training of young scientists to qualify them to extend and take over the work. The Institute will differ from the operating units in having its own Board of Trustees.

The possibility of general aid to rice-producing countries in increasing yield has been under active discussion between The Ford and Rockefeller Foundations for several years. Considerable research on rice has been done in Japan, the United States, India, and other countries, but there is general agreement that more is needed. The two foundations decided to join forces to establish a research center of outstanding quality in contrast to supporting a larger number of limited projects, though support to other institutions studying this plant is not thereby ruled out.

The idea of an international institute devoted to rice research evolved from these discussions and from consultations with scientists, officials, and leaders in a number of countries. After the division of responsibility between the two foundations for the projected institute was agreed on, the decision was made to establish it in the Philippines. A number of reasons dictated the choice: rice forms a major part of the Philippine diet; soil and climate vary sufficiently to permit cultivation of the two major types, *japonica* and *indica;* the Islands are easily accessible to other eastern rice-



THE INTERNATIONAL RICE RESEARCH INSTITUTE, Los Banos, The Philippines

FROM LEFT TO RIGHT: *Administration building, community hall with dormitory behind, and laboratory.*

growing countries; and the Government of the Philippines had evinced cordial interest in the project.

Following preliminary negotiations with the Government, both Foundations appropriated funds for initial development, and in December, 1959, Juan de G. Rodriguez, then Secretary of Agriculture and Natural Resources of the Republic of the Philippines, arrived in New York to sign a "memorandum of understanding" with Henry T. Heald, President of The Ford Foundation, and Dean Rusk, President of The Rockefeller Foundation.

Citing the urgency of the purpose for which the Institute had thereby come into being, the memorandum said in part:

> The fact that many areas of the world are deficient in the production of basic foods essential to the nutrition of local populations is of growing public concern. Among those plant products which provide the bulk of the world's food, rice is preeminent; it is the world's most important cereal and serves as the principal daily food for more individuals than does any other food crop. Unfortunately, however, the annual supply of rice falls far short of needs in many rice-consuming countries and the situation is becoming increasingly serious with progressive population increases. In many of these countries rice varieties are unimproved and cultivators make little use of modern techniques of production with the result that yields are far below production potentials.

Director of the Institute is Dr. Robert F. Chandler, Jr., Associate Director for Agricultural Sciences of The Rockefeller Foundation, and Assistant Director is Dr. L. Sterling Wortman, former geneticist with The Rockefeller Foundation's Mexican Agricultural Program, and most recently head of the plant breeding department of the Hawaiian Pineapple Research Institute. They have been working in temporary headquarters in Manila for some months. An agricultural engineer has been appointed and will soon arrive, to be followed by a finance officer.

By early 1962 the Institute expects to have completed its staff of senior scientists, drawn chiefly from the rice-producing countries of South and Southeast Asia, including a plant breeder, geneticist, taxonomist, plant physiologist, plant pathologist, entomologist, soil chemist, soil physicist, agronomist, agricultural economist, agricultural engineer, and a biochemist. Each senior staff member will have one or more junior scientists working with him, as well as varying numbers of trainees. The senior staff will be supplemented from time to time by visiting researchers.

The Board of Trustees, which met first in April, 1960, is also an international one. In addition to the Institute's Director, it includes Prince M. C. Chakrabandhu, Director of the Rice Department in the Ministry of Agriculture, Thailand; Mr. K. R. Damle, Secretary of Food and Agriculture, India; Dr. Paulino Garcia, Chairman of the National Science Development Board, the Philippines; Dr. Forrest F. Hill, Vice-President of The Ford Foundation; Dr. Hiroshi Kihara of the National Institute of Genetics, Japan; Dr. P. C. Ma, Dean of the College of Agriculture of National Taiwan University, Formosa; the Honorable Juan de G. Rodriguez; and Dr. Vicente G. Sinco, President of the University of the Philippines. Dr. J. G. Harrar, Vice-President of The Rockefeller Foundation is Chairman of the Board.

Construction of the buildings, which are to include a field house, a central research laboratory, a combination administration building, library, and auditorium, and a housing development for resident staff, is expected to begin October, 1960, and be completed by April, 1962. Consulting architect is Mr. Ralph Walker of the New York firm of Voorhees, Smith, Smith, and Haines. The firms of C. D. Arguelles Associates, and A. J. Luz Associates, both of Manila, have executed the final plans. The one-story buildings will utilize modular metal-framed glass curtain walls, native brick, and glass, marble, and stone finishes, and will stand beneath a coconut grove surrounded by open fields planted principally of rice.

A standard system of nomenclature for human mitotic chromosomes is considered by an international group

Human Chromosomes Study Group

Proposed Chromosome Nomenclature

THE RAPID GROWTH of knowledge of human chromosomes in several laboratories, following advances in technical methods, has given rise to several systems by which the chromosomes are named. This has led to confusion in the literature and so to the need for resolving the differences. Consequently, at the suggestion of Dr. C. E. Ford, a small study group was convened to attempt the formulation of a common system of nomenclature. The meeting was arranged, through the good offices of Dr. T. T. Puck, held in Denver, at the University of Colorado, under the auspices of the Medical School. The meeting of this study group was made possible by the support of the American Cancer Society, to whom grateful thanks are due. For practical reasons, it was decided to keep the group as small as possible and to limit it to those human cytologists who had already published karyotypes.[1] In addition, three counselors were invited to join the group to guide and aid the discussions and, if necessary, to arbitrate. Fortunately, the last office did not prove necessary, and it was possible by mutual agreement to arrive at a common system which has flexibility.

Principles for the System

It was agreed that the principles to be observed by the system should be simplicity and freedom, as far as possible, from ambiguity and risks of confusion, especially with other systems of nomenclature in human genetics. It should also be capable of adjustment and expansion to meet the needs of new knowledge of human chromosomes. The system should be agreed to by the greatest possible proportion of cytologists working in the field, but the risk that a minority may be unable to accept the system as a whole should not be allowed to delay adoption by a majority.

It was agreed that the autosomes should be serially numbered, 1 to 22, as nearly as possible in descending order of length, consistent with operational conveniences of identification by other criteria. The sex chromosomes should continue to be referred to as X and Y, rather than by a number, which would be an additional and ultimately, a superfluous appellation.

It was generally agreed that the 22 autosomes can be classified into seven groups, distinction between which can readily be made. Within these groups, further identification of individual chromosomes can in many cases be made relatively easily. Within some groups, especially the group of chromosomes numbered 6-12, including also the X chromosome, the distinctions between the chromosomes are very difficult to make by presently available criteria. However, lesser difficulties are encountered in separating chromosomes 6 and the X from the remainder of this group. It is believed that, with very favorable preparations, distinctions can be made between most, if not all, chromosomes.

It is proposed that the autosomes first be ordered by placing the seven groups as nearly as possible in descending order of size. Within each group the chromosomes are arranged, for the most part, by size. It was desired specifically to avoid the implication that size relationships have been permanently decided in every instance, but it is hoped that the assignment of numbers will be permanently fixed. In those cases where distinction is at present doubtful, final definition of each chromosome can be left until further knowledge has accrued, though an attempt is made to provide a characterization of each. These principles make it possible to draw up a conspectus of the chromosomes, a table of their quantitative characteristics and a table of the synonyms which authors have already published. These are appended (Tables 1, 2 and 3).

In Table 2, showing the diagnostic characters of the chromosomes, three parameters are relied upon. These

[1] In contemporary publications the terms, karyotype and idiogram, have often been used indiscriminately. We would recommend that the term, *karyotype*, should be applied to a systematized array of the chromosomes of a single cell prepared either by drawing or by photography, with the extension in meaning that the chromosomes of a single cell can typify the chromosomes of an individual or even a species. The term, *idiogram*, would then be reserved for the diagrammatic representation of a karyotype, which may be based on measurements of the chromosomes in several or many cells.

TABLE 1—Conspectus of Human Mitotic Chromosomes

Group 1–3	Large chromosomes with approximately median centromeres. The three chromosomes are readily distinguished from each other by size and centromere position.
Group 4–5	Large chromosomes with submedian centromeres. The two chromosomes are difficult to distinguish, but chromosome 4 is slightly longer.
Group 6–12	Medium sized chromosomes with submedian centromeres. The X chromosome resembles the longer chromosomes in this group, especially chromosome 6, from which it is difficult to distinguish. This large group is the one which presents major difficulty in identification of individual chromosomes.
Group 13–15	Medium sized chromosomes with nearly terminal centromeres ("acrocentric" chromosomes). Chromosome 13 has a prominent satellite on the short arm. Chromosome 14 has a small satellite on the short arm. No satellite has been found on chromosome 15.
Group 16–18	Rather short chromosomes with approximately median (in chromosome 16) or submedian centromeres.
Group 19–20	Short chromosomes with approximately median centromeres.
Group 21–22	Very short, acrocentric chromosomes. Chromosome 21 has a satellite on its short arm. The Y chromosome is similar to these chromosomes.

are: 1) The length of each chromosome relative to the total length of a normal, X-containing, haploid set, i.e., the sum of the lengths of the 22 autosomes and of the X chromosome, expressed per thousand; 2) The arm ratio of the chromosomes expressed as the length of the longer arm relative to the shorter one; and 3) The centromeric index expressed as the ratio of the length of the shorter arm to the whole length of the chromosome. The two latter indices are, of course, related algebraically quite simply, but it is thought useful to present both here. In some chromosomes, the additional criterion of the presence of a satellite is available (Table 1), but in view of the apparent morphological variation of satellites, they and their connecting strands are excluded in computing the indices.

Table 2 shows the range of measurements determined by various workers. Some of the variation expresses the uncertainty due to measurement of relatively small objects; but many of the discrepancies between different workers' observations are due to the measurement of chromosomes at different stages of mitosis and to the effect of different methods of pretreatment and preparation for microscopic study. The ranges shown, therefore, represent the maxima and minima of the means found by different workers using different techniques. However, within any one worker's obser-

TABLE 2—Quantitative Characteristics of the Human Mitotic Chromosomes

All measurements were made from cells of normal individuals, except those made by Fraccaro and Lindsten, which included cases of Turner's Syndrome. The column A is the relative length of each chromosome, B is the arm ratio and C the centromere index, as defined in the test.

	Tjio and Puck (6)			Chu and Giles (2)			Levan and Hsu (5)			Fraccaro and Lindsten[a]			Lejeune and Turpin (4)[a]			Buckton, Jacobs and Harnden[a]			Range		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
1	90	1.1	48	90	1.1	48	85	1.1	49	82	1.1	48	83	1.1	48	87	1.1	48	82-90	1.1	48-49
2	82	1.6	39	83	1.5	40	79	1.6	38	77	1.5	40	84	1.5	40	79	1.6	38	77-84	1.5-1.6	38-40
3	70	1.2	45	72	1.2	46	69	1.2	45	65	1.2	45	67	1.2	46	63	1.2	46	63-72	1.2	45-46
4	64	2.9	26	63	2.9	26	63	2.7	27	62	2.6	28	62	2.6	25	60	2.6	28	60-64	2.6-2.9	25-28
5	58	3.2	24	58	3.2	24	59	2.6	28	60	2.4	29	57	2.4	30	57	2.4	30	57-60	2.4-3.2	24-30
X	59	1.9	34	57	2.8	38	52	1.6	38	54	1.6	38	58	2.2	32	51	1.7	37	51-59	1.6-2.8	32-38
6	55	1.7	37	56	1.8	36	56	1.7	37	54	1.6	38	56	1.7	37	56	1.6	38	54-56	1.6-1.8	36-38
7	47	1.3	43	52	1.9	35	51	1.9	35	50	1.7	37	51	1.8	36	50	1.7	37	47-52	1.3-1.9	35-43
8	44	1.5	29	46	1.7	29	48	1.6	33	47	1.7	37	48	2.4	29	46	1.5	40	44-48	1.5-2.4	29-40
9	44	1.9	40	46	2.4	38	47	1.8	36	45	2.0	33	47	1.9	35	44	2.1	32	44-47	1.8-2.4	32-40
10	43	2.4	27	45	2.3	30	45	2.0	33	45	2.6	34	45	2.6	27	44	1.9	35	43-45	1.9-2.6	27-35
11	43	2.8	34	44	2.1	32	44	2.2	31	43	2.2	31	44	1.6	39	43	1.5	40	43-44	1.5-2.8	31-40
12	42	3.1	24	43	3.1	24	42	1.7	32	43	1.7	37	42	2.8	27	42	2.1	32	42-43	1.7-3.1	24-37
13	35	8.0	11	32	9.7	10	32	5.0	16	34	4.8	17	33	6.8	14	36	4.9	17	32-36	4.8-9.7	10-17
14	32	7.3	12	34	9.5	9	37	4.0	18	35	4.4	19	32	7.0	13	34	4.3	19	32-37	4.3-9.5	9-19
15	29	10.5	9	31	11.9	8	35	4.7	17	33	4.6	22	31	10.0	9	34	3.8	22	29-35	3.8-11.9	8-22
16	32	1.8	36	27	1.6	38	30	1.4	42	31	1.4	42	29	1.4	41	33	1.4	31	27-33	1.4-1.8	31-42
17	29	2.8	26	30	2.1	33	29	2.4	30	30	1.9	35	29	3.1	23	30	1.8	36	29-30	1.8-3.1	23-36
18	24	3.8	21	25	3.8	22	25	2.6	28	27	2.5	29	26	4.2	21	27	2.4	29	24-27	2.4-4.2	21-29
19	22	1.4	41	22	1.9	34	24	1.2	40	25	1.3	43	22	1.4	42	26	1.2	45	22-26	1.2-1.9	34-45
20	21	1.3	44	19	1.3	44	21	1.2	40	23	1.3	43	20	1.2	43	25	1.2	46	19-25	1.2-1.3	40-46
21	18	3.7	21	15	6.8	13	13	2.5	28	19	2.5	29	15	2.3	31	20	2.5	29	13-20	2.3-6.8	13-31
22	17	3.3	23	12	6.0	14	16	2.0	33	17	2.3	30	13	4.0	20	18	2.7	27	12-18	2.0-6.0	14-33
Y	19	∞	0	11	∞	0	18	4.9	17	22	2.9	26	18	∞	0	18	4.9	17	11-22	2.9-∞	0-26

[a] Unpublished data.

vations, the variations are not so broad.

Reference should be made to two other matters of nomenclature. In the first place, it is considered that no separate nomenclature for the groups is needed. It is considered that any group to which it may be necessary to refer will be a sequence of those designated by Arabic numerals. Hence, any chromosome group may be referred to by the Arabic numerals of the extreme chromosomes of the group, joined together by a hyphen, e.g., the group of the three longest chromosomes would be Group 1-3. This scheme has the merit of great flexibility. For instance, chromosomes X and 6 may be separated from the Group 6-12 whenever they can be distinguished.

Abnormal Chromosome Nomenclature

Secondly, there is the problem raised by the abnormal chromosomes which are being encountered in the more recent studies. Their nomenclature was discussed without a definite conclusion being reached. Broadly, it was agreed, however, that any symbol used should avoid incorporating a specific interpretation which was not reasonably established. It was suggested that arbitrary symbols, prefixed by a designation of the laboratory of origin, should usually be assigned to the abnormal chromosome.

In this connection, two further requisites for coordination of research were discussed. One is the storage of documentation for reference, perhaps in a central depository, additional to what it may be possible to publish. The other is the desirability that cultures be preserved, by the satisfactory methods now used, so that they are available for reference, comparison and exchange.

Some consideration was also given to the desirability of using a uniform system for presenting karyotypes and idiograms, but recognizing that individual variation in taste is involved, rigidity of design was thought undesirable. However, it was recommended that the chromosomes should be arranged in numerical order, with the sex chromosomes near to but separated from the autosomes they resemble. It is desirable that similar ones be grouped together with their centromeres aligned.

It is recognized that choice between the different possible schemes of nomenclature is arbitrary, but that uniformity for ease of reference is essential. Hence, individual preferences have been subordinated to the common good in reaching this agreement. This human chromosomes study group therefore agrees to use this notation and recommends that any who prefer to use any other scheme should, at the same time, also refer to the standard system here proposed.

We are well aware of the wide interest in the work of this study group and realize that this meeting is merely a preliminary to a larger meeting. It is believed that two needs have to be met in this respect. One is for seminars and workshops at which workers in the field may exchange information; such seminars are best arranged regionally. The second need, which may come later, is for international conferences; and we believe that congresses and other organizations whose interests include human genetics, should promote such meetings.

TABLE 3—Synonymy of Chromosomes as Published by Various Workers

New Chromosome Number	Tjio and Puck (6)	Chu and Giles (2)	Levan and Hsu (5)	Ford, Jacobs and Lajtha (3)	Böök, Fraccaro and Lindsten (1)	Lejeune, Turpin and Gautier (4)
1	1	1	1	1	1	G1
2	2	2	2	2	2	G2
3	3	3	3	3	3	G3
4	4	4	4	4	4	G4
5	5	5	5	5	5	G5
6	6	6	6	6[a]	6	M1
7	7	7	7	(8)	7	M2
8	8	8	8	(9)	8	Md1
9	9	9	9	(11)	9	M3
10	10	10	10	10	10	Md2
11	11	11	11	(12)	11	M4
12	12	12	12	(13)	12	Md3
13	18	14	20	14	14	T1
14	19	15	18	15	15	T2
15	20	13	19	16	13	T3
16	13	17	15	19	16	C1
17	14	16	13	17	17	P1
18	15	18	14	18	18	P2
19	16	19	16	20	19	C2
20	17	20	17	21	20	C3
21	21	21	22	22	21	Vh
22	22	22	21	23	22	Vs
X	X	X	X	(7)	X	X
Y	Y	Y	Y	Y	Y	Y

[a] In the published idiogram the chromosomes of group 6-12 (including X) were indicated by discontinuous lines and left unnumbered owing to the uncertainty of discrimination at that time. For the purpose of this table, these chromosomes have been assigned the numbers shown in brackets, in serial order of length.

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THE EDITOR'S DESK

A card file on all research problems in the field of plant taxonomy that are currently being worked on in North America is being established by Raymond C. Jackson, Department of Botany, University of Kansas, Lawrence. All botanists involved in taxonomic work are requested to write Dr. Jackson for further information.

The Museum Building of the **New York Botanical Garden,** which includes the library, has been closed to visitors for extensive renovation.

The Indian Council of Agricultural Research has initiated a program of research on algae. The series is to consist of about 20 volumes of which "Zygnemaceae," by M. S. Randhawa, and "Cyanophta," by T. V. Desikachary have been published. Further information may be obtained from the Council, Queen Victoria Road, New Delhi, India.

The **Statistical Laboratory at Catholic University** is expanding its activities into the areas of biomathematics and biometry. A training program and a consulting service are being organized. Edward Batschelet, recently of the University of Basel, Switzerland, is in charge of the service. Biologists who wish to consult on mathematical or statistical problems should contact Eugene Lukacs, Director, Statistical Laboratory, Catholic University Washington 17, D. C.

The Smithsonian Institution is considering reprinting Standley's "Trees and Shrubs of Mexico" which has been out of print for years, and would welcome expressions of interest, directed to Editorial and Publications Division, Smithsonian Institution, Washington 25, D. C.

"Biooxidation of Industrial Wastes" and "Recent Developments in Water Bacteriology" are the subjects of two courses that will be offered at the **Robert A. Taft Sanitary Engineering Center** in January. For information write to the Chief of the Training Program at the Center, 4676 Columbia Parkway, Cincinnati 26, Ohio.

In September the inauguration of the **"Future Scientists of America"** took place. This is an activity of the National Science Teachers Association dealing with services, materials for teachers, and club-type organizations for students. Information about the extensive plans of the program may be obtained from the NSTA, 1201 16th St., N.W., Washington, D. C.

The AIBS has been asked by the **Society for Industrial Microbiology** to serve as a full co-sponsor of next year's Conference on Antimicrobial Agents. SIM put on this year's meeting at the Mayflower Hotel, October 26–28, which proved highly successful and attracted nearly 500 scientists.

The American Society of Ichthyologists and Herpetologists will hold their 1961 meeting at the University of Texas in Austin from March 31 through April 2.

A symposium on the blood protozoa of birds, under the sponsorship of the **Wildlife Disease Assn.** and the **U. S. Fish and Wildlife Service,** will be held March 3 and 4, 1961 at the Patuxent Wildlife Research Center, Laurel, Md. Dr. C. M. Herman, Patuxent Wildlife Research Center, Laurel, Md., is program chairman.

The American Geographical Society announces the availability of the AGS Biogeographical Atlas of the North Atlantic, a set of base maps designed to facilitate the plotting of all manner of scientific data, both biological and physical. There is no charge for the sheets; however, those scientists and institutions ordering them are requested to pay for postage and cost of container used for shipping.

Descriptive information and order forms may be obtained from The American Geographical Society, Broadway at 156th Street, New York City 32.

AAAS announces the publication of a Symposium on **Aging—Some Social and Biological Aspects.** Editor: Nathan V. Shock, 430 p., 65 illus., Index.

A new publication will be initiated soon by the **Crop Science Society of America,** an affiliate of the **American Society of Agronomy.** This journal will be called **Crop Science** and will carry reports of research in the breeding, genetics, physiology, ecology, and management of field crops, pastures, ranges and turfgrasses.

Awards

The Botanical Society of America reports that the Darbaker Prize was awarded to Janet R. Stein of the University of California for meritorious work in the study of algae. Awards for outstanding contributions to American botany were made to: Reed C. Collins, James P. Bennett, Walter C. Muenscher, William D. Billings, and Kenneth B. Raper.

The Poultry Science Research Award went to U. K. Abbott, University of California.

Rebecca C. Lancefield of the Rockefeller Institute received the third **T. Duckett Jones Memorial Award** of the Helen Hay Whitney Foundation.

The American Society of Horticultural Science reports the following awards: The Alex Laurie Award to Joe J. Hanan; The Charles G. Woodbury Award to H. T. Hartmann, Marion Simone, R. H. Vaughan, and E. C. Maxie; The Joseph Harvey Gourley Award to E. C. Maxie, M. V. Bradley, B. J. Robinson, and A. A. Hewitt; The Leonard H. Vaughan Award in Vegetable Crops to H. C. Mohr and C. M. Watkins; and the Leonard H. Vaughan Award in Floriculture to Sam Asen, N. W. Stuart, and H. W. Siegelman.

Grants

The University of Wisconsin has been given a grant from the National Science Foundation for a new center for the University's basic and applied lake research.

Two National Science Foundation Grants have been awarded to the **Institute for Cancer Research** in Philadelphia. One grant will support a 3-year basic research project entitled "Specific Syntheses in Bacteria and Bacteriophages." The other is for the establishment and maintenance of a *Drosophila melanogaster* Stock Center.

Grants-in-aid usually ranging between $500 and $1500 are available from funds administered by the **American Academy of Arts and Sciences** for research in any recognized scientific field. Requests for the purchase of nonexpendable laboratory equipment usually available in the institutions

of higher learning are in general not considered. Support is not usually given for work aimed primarily at fulfilling the requirements of an academic degree. Inquiries and requests for application forms should be addressed to: Committee on Research Funds, American Academy of Arts and Sciences, 280 Newton Street, Brookline Station, Boston 46, Mass., USA.

Scholarships and Fellowships

Applications are invited for two **Turtox Scholarships** established by General Biological Supply House, Inc., to aid those contemplating or continuing study for the doctorate degree in botany, zoology, or biology. Applications must be received by February 1, and should be requested from Chairman of Award Committee, Frank A. Brown, Jr., Department of Biological Sciences, Northwestern University, Evanston, Illinois.

The Lalor Foundation has announced its program of grants and awards for 1961 for support of research on the fundamental biochemical and physiological mechanisms concerned with fertility and the early stages of reproduction in various forms of life. The awards include project grants, summer research awards and senior fellowships at the Woods Hole Marine Biological Laboratory. For information write the Lalor Foundation, 4400 Lancaster Pike, Wilmington 5, Delaware.

Scholarships and fellowships in conservation are being awarded by the **National Wildlife Federation.** For information, write to the Executive Director of the Federation, 1412 16th Street, N.W., Washington 6, D. C.

Applications will be accepted until January 6 for **Organization for European Economic Cooperation Senior Visiting Fellowships.** The program includes study in most fields of science and technology, and assists institutions in sending senior staff members to study new techniques and developments. For information: National Academy of Sciences-National Research Council, 2101 Constitution Ave., N.W., Washington 25, D. C.

International Meetings

The Purdue International Seminar on Instructional Television, with the assistance of UNESCO, will take place October 8 to 18, 1961. Warren F. Seibert, Seminar Director, at Purdue, can supply further information.

The Third World Congress of Psychiatry will take place June 4 to 10 in Montreal. For information: General Secretary of the Congress, 1025 Pine Ave. West, Montreal 2, P.Q., Canada.

The International Medical-Surgical Film Festival, Turin, June 3-11, will be the occasion for a large number of international meetings including the World Symposium on Genetics, and the World Symposium on the Physiopathology of Renal Papilla. Information may be obtained from the General Secretariat of the Festival, Minerva Medica, Corso Bramonte 83-85, Turin, Italy.

Other international meetings and their information addresses are: **International Symposium "Microbial Reactions in Marine Environments,"** Chicago, April 20-24. Carl H. Oppenheimer, Institute of Marine Science, University of Texas, Port Aransas, Texas.

International Congress of Animal Husbandry, Hamburg, June 12-18. European Association for Animal Production, Via Barnaba Oriani 28, Rome, Italy.

International Congress of Biochemistry, Moscow, August 10-16. N.M. Sissakian, Leninsky prospekt 33, Moscow B-71, USSR.

Pacific Science Congress, Honolulu, August 21-September 2. Secretary General of the Congress, Bishop Museum, Honolulu 17, Hawaii.

The Bahamas Conferences include Conference on Hypertension, January 8-14; Second Allergy Conference, February 9-15; Eleventh Medical Conference, April 3-15; Conference on Internal Medicine, April 30-May 6. The Bahamas Conferences, P.O. Box 1454, Nassau.

The NAS-NRC ad hoc Committee on International Relations in Biophysics has obtained funds to assist a number of U. S. biophysicists to attend the **International Congress of Biophysics,** Stockholm, 31 July–4 August 1961.

A special committee has been established to screen applications for travel grants. *Applications must be received no later than 31 December 1960.* Application forms may be obtained from Committee on International Relations in Biophysics, Div. of Biology and Agriculture, NAS-NRC, 2101 Constitution Avenue, Washington 25, D. C.

The First International Conference on Trichinosis convened in Warsaw, Poland, on September 12, 1960, and formal papers were presented on that and the following day. Emphasis was placed on sylvatic trichinosis and its spread to pigs—the common source of human trichinosis.

Before the conference adjourned, it approved the appointment of an International Commission on Trichinosis, with headquarters at Wroclaw, Poland, and of an Executive Committee to develop and implement its programs. The following were named as members of the Executive Committee: Dr. Benjamin Schwartz, Consulant in Parasitology, Meat Inspection Division, U. S. Department of Agriculture, Chairman; Dr. S. E. Gould, University of Michigan, Vice-Chairman; Prof. R. Lehmensick, University of Bonn, West Germany; Prof. L. W. Orlov, University of Moscow, USSR; Prof. L. Guilhon, College of Veterinary Medicine, Alfort, France; Dr. F. E. Kruidenier, University of Illinois, Assistant to the Chairman.

The First International Conference on Protozoology, arranged under the auspices of the Czechoslovak Academy of Sciences, will be held jointly with the Thirteenth Meeting of the Society of Protozoologists in Prague, August 22-30, 1961. It will be possible to provide financial assistance for travel to the Prague meeting to a limited number of qualified United States scientists who wish to present a paper. Applicants should write to: William Trager, President, Society of Protozoologists, The Rockefeller Institute, 66th Street & York Avenue, New York 21, N. Y. stating the general nature of the paper they plan to give and should include a brief vita and summary of their scientific career. *Applications must be received not later than January 3, 1961.* Applicants will be notified February 1, 1961.

Notes on Biologists

Joshua Melvin Leise has joined the staff of the National Science Foundation as Program Director for Life Science Facilities. He was previously with the Army Research Office as Chief of the Biophysics-Biochemistry Branch.

William Hay Taliaferro, upon his retirement as Professor and Chairman of the Department of Microbiology at the University of Chicago, has been appointed Senior Immunologist in the Division of Biological and Medical Research of the Argonne National Laboratory.

A leave of absence has been given by Lehigh University to **Francis J. Trembley,** Professor of Ecology. A Senior Visiting Fellowship of the Organization for European Economic Cooperation has enabled him to make a study of streams in England.

Kenneth L. Webb has accepted an appointment with the University of Georgia Marine Institute at Sapelo Island as Assistant Professor of Botany.

Professor of Biochemistry at the Sorbonne, Paris, **Jacques Monod,** was visiting lecturer in biology at the Institute of Molecular Biology at the University of Oregon during the month of October.

R. D. Henry, Assistant Professor of Botany at Ohio Wesleyan University has accepted a position as Assistant Professor of Biological Sciences at Western Illinois University.

H. Stanley Bennett has been appointed Dean of the Division of the Biological Sciences at the University of Chicago.

The appointment of **David Keller Caldwell** as Curator of Marine Zoology at the Los Angeles County Museum has been announced.

George P. Fulton, Chairman of the Biology Department at Boston University's College of Liberal Arts and Graduate School, has been renamed Shields Warren Professor of Biology.

The Colgate-Palmolive Company has announced the appointment of biochemist **C. John Di Cuollo** to the Research and Development Department.

Robert J. Schnitzer has joined the scientific staff of Academic Press, publishers.

Libbie H. Hyman, American Museum of Natural History, was elected an Honorary Member of the Society of Protozoologists in recognition of meritorious service in the field of protozoology.

The Institute of Cancer Research has announced the appointment of **Thomas J. King** to the post of Senior Member.

Miles D. McCarthy, formerly Professor and Chairman of the Zoology Department at Pomona College is Professor of Biology and Chairman of the Division of Science and Mathematics at newly-established Orange County State College, California.

J. C. Walker, Professor of Plant Pathology, University of Wisconsin, was awarded an Honorary Doctor of Science degree by the University of Göttingen, Germany.

Merrill Stafford Read, formerly of the Department of Biochemistry and Nutrition, Virginia Polytechnic Institute, has become Director of Nutrition Service for the National Dairy Council, 111 N. Canal St., Chicago, Illinois.

Rev. Joseph Schuh, S.J., Chairman of the Department of Biology, Saint Peter's College, Jersey City, N.J. has been granted sabbatical leave until February 1961. He will collaborate with **Paul Nace** of McMaster University, Canada in studies on experimental diabetes at the Marine Biological Laboratory, Woods Hole, Mass.

William F. Harrington has been appointed Professor of Biology in the McCollum-Pratt Institute, Johns Hopkins University.

Wallace O. Fenn, Professor of Physiology at the University of Rochester School of Medicine and Dentistry, and past president of the AIBS, received the honorary degree, *Doctor Honoris Causa,* from the Faculty of Medicine of the University of Paris.

Peter Brian Medawar, co-winner of the 1960 Nobel Prize in Physiology and Medicine, was educated at Marlborough College and Oxford University where he collected a record number of prizes, scholarships and fellowships. Now Jodrell Professor for Zoology at the University of London, Dr. Medawar is known to a wider public in England and America as a scientific essayist. He has written on growth, regeneration, aging and tissue transplantation, and his papers have appeared in Science, Journal of the American Medical Association, and British periodicals. Two full length books by him have appeared: *The Uniqueness of the Individual* (1957, Basic Books, New York) and *The Future of Man* (1960, Basic Books).

"The Growing Political Role of the Academic Scientist" was examined in the opening address of a two-day conference on science and society held at Vassar College on November 4 and 5. The initial speaker was **Dr. Bentley Glass,** geneticist and Professor of Biology at the Johns Hopkins University. Dr. Glass, a former president of the American Association of University Professors, considered the appropriate role of scientists in policy making.

The reappointment of **Dr. Dwight Barnett** to serve on the National Advisory Council on Health Research Facilities was announced recently. Dr. Barnett, Director of the Palo Alto-Stanford Hospital Center, Palo Alto, California, was originally appointed to the Council in February of 1959, and will now serve through August 1961.

Doctor Manuel Morales, Career Investigator of the American Heart Association and formerly Professor and Chairman of the Department of Biochemistry at Dartmouth Medical School, has been appointed Professor of Biochemistry at the University of California School of Medicine (San Francisco) and Staff Member of the Cardiovascular Research Institute.

Reports of the Election of New Officers from the Societies

At annual meetings held in Oklahoma in August, many new officers were elected.

The American Society for Horticultural Science reports—President; Vernon T. Stoutmyer, University of California at Los Angeles: Vice-President; F. S. Jamison, University of Florida: Secretary-Treasurer; Roy E. Marshall, Michigan State University: Chairman of 1961 Program Committee; E. C. Stevenson, Purdue University: Chairmen of Sections; J. M. Beattie, Ohio Agricultural Experiment Station (Pomology); H. M. Munger, Cornell University (Vegetable Crops); C. B. Link, University of Maryland (Floriculture and Ornamental Horticulture); A. L. Rydall, U.S.D.A. Plant Industry Station (Handling and Processing).

The American Society of Plant Taxonomists reports the following officers for 1961—Chairman of the Council; Mildred Mathias, University of California at Los Angeles: Secretary; C. Ritchie Bell, University of North Carolina: Treasurer; Richard W. Pohl, Iowa State University.

The Society of Protozoologists reports —President; William Trager, the Rockefeller Institute, New York: Vice President; S. H. Hutner, Haskins Laboratories, New York: Treasurer; Robert Samuels, University of Colorado: Acting Secretary; Norman D. Levine, University of Illinois.

New officers of the **Botanical Society of America** for 1961 are as follows—President: Vernon I. Cheadle, Univ. of California at Berkeley; Vice President: Reed C. Rollins, Harvard Univ.; Editorial Committee: John Torrey, Harvard Unit.

From the **Society for the Study of Development and Growth**—President; William P. Jacobs, Princeton University: Secretary; Armin Braun, Rockefeller Institute, New York: Treasurer H. Clark Dalton, New York University.

The Botanical Society of America reports that Vernon I. Cheadle, University of California, has been elected President for 1961, and Reed C. Rollins, Harvard University, Vice President.

Officers for 1961 of the **Poultry Science Association**—President; T. C. Byerly, U.S. Department of Agriculture: 1st Vice President; C. S. Shaffner, University of Maryland: 2nd Vice President; R. G. Jaap, Ohio State University: Secretary-Treasurer; C. B. Ryan, Texas A&M College.

The American Society of Limnology and Oceanography reports—President; W. T. Edmondson, University of Washington: Vice President; G. A. Riley, Yale University.

Officers erroneously reported in the October *Bulletin* for the **American Society of Zoologists** were actually elected for the **XVI International Congress of Zoology** to be held in August, 1961.

The Society for Industrial Microbiology reports—President, **Arthur M. Kaplan,** Quartermaster, Research and Engineering Center, Natick, Mass.; Vice President, **Frederick Kavanagh,** Eli Lilly Co.; Secretary, **Brinton Miller,** Merck Sharp & Dohme; Treasurer, **S. S. Block,** University of Florida; and new members of the Board of Directors: **L. S. McClung,** Indiana University, **C. L. Porter,** Purdue University.

Recent Deaths Among Biologists

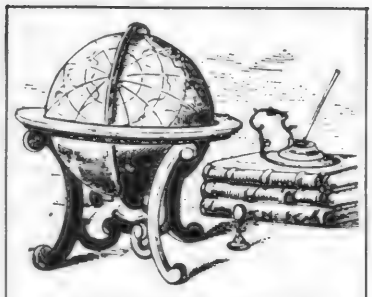
Thurlow Christian Nelson, marine biologist, Cape May, New Jersey, September 12.

Hermann I. Schlesinger, Emeritus Professor of Chemistry, University of Chicago.

Walter F. Loehwing of the State University of Iowa.

A. B. Lamb, Head of the Bacteriology Section, Defence Research Board Establishment at Suffield, Alberta.

Peter O. Okkelberg, Professor Emeritus of Zoology and Associate Dean Emeritus of the Graduate School, University of Michigan, Ann Arbor, Mich., September 13.



AIBS REPORTS

AIBS is happy to announce the availability this month of the ***Style Manual for Biological Journals.*** Prepared by the Committee on Form and Style of the Conference of Biological Editors, the *Style Manual* is designed for biologists preparing manuscripts for publication in scientific journals. Seventy-six journals have adopted this manual, in whole or in part, so as to establish uniform standards in biological publications. (*see p. 44.*)

AIBS now offers an additional service —the solicitation and handling of **advertising for journals** of Member and Affiliate Societies and others. Advertising services are provided for the *Abstracts of Bioanalytic Technology, American Documentation,* and *American Journal of Human Genetics.* Experience so far seems to assure additional income for the participating Societies.

Business management services are being provided for the American Association of Bioanalysts, American Documentation Institute, American Eugenics Society, International Association of Dental Research, and the Wildlife Disease Association.

Redactory services are being performed for the following journals: *AAB Bulletin, Abstracts of Bioanalytic Technology, American Documentation, The Biologist, Journal of Economic Entomology,* and *Wildlife Disease.*

A grant of $5000 has been received from the **National Science Foundation** to support the publication of the Russian monograph "Monogenetic Trematodes, Their Systematics and Phylogeny," by Boris E. Brychowsky. The monograph was translated under the direction of William J. Hargis, Jr., Director of the Virginia Fisheries Laboratory.

The AIBS, under a grant from the National Institute of Allergy and Infectious Diseases, is currently publishing **An Annotated Bibliography of Influenza.** Volume 1, Number 1, which has recently been released, contains 176 references in eight different categories: general and review; epidemiology; clinical; pathology; prophylaxis; immunology; virology; and animal studies.

The first issue contains references from over 2600 journals for the period June 1 through August 31, 1960. The second issue will contain references for the remainder of 1960. In 1961 there will be four quarterly issues. The final issue each year will contain a subject-author index for the entire year. A separate volume, soon to be published, will contain all references to this subject for the period January 1, 1957 through May 31, 1960. (*see p. 18.*)

The First International Congress on Research in Burns was held at the National Naval Medical Center, Bethesda, Maryland, September 19–22, 1960. Civilian, military physicians and research biologists from 17 nations participated in the Congress. The Congress was supported by the **U.S. Public Health Service** and **co-sponsored by the Medical Departments of the Army, Navy, Air Force, and by the American Institute of Biological Sciences.**

Fifty-six research and clinical investigation reports were presented on every phase of prevention and treatment of burns, tissue transplantation, electrolyte balance and metabolism, and prevention of infection. Approximately half of the papers were presented by foreign scientists. The research papers included the most important experimental and clinical research developments of the past five years. The Congress is the first meeting for scientists to exchange reports on burn research since 1955. **Curtis P. Artz, M.D.,** Univ. of Mississippi Medical Center, Jackson, Miss., was coordinator of the Congress program. **Howard T. Karsner, M.D.,** Medical Research Advisor to Surgeon General of the U.S. Navy, served as Chairman of the Planning Committee for the Congress. Representatives of the Army, Navy, Air Force, Public Health Service, and the AIBS also served on the Planning Committee. Plans are now in progress for the publication of the proceedings of the Congress which will be supported jointly by the Air Force, Army, Navy and NIH.

John R. Olive recently announced his decision to stay on at AIBS after having spent a year's sabbatical leave here from Colorado State University. He has been appointed Deputy Executive Director of AIBS by Hiden T. Cox, Executive Director. Dr. Olive will continue to attend meetings and

conferences on behalf of AIBS. His recent travels have included a trip to Purdue University to discuss the 1961 Annual AIBS Meetings, and a meeting with the Film Series staff in Kansas City.

Employers of biologists who are seeking qualified personnel for their current and/or anticipated vacancy(ies) are invited to visit the AIBS Placement Service Office. Current applications of approximately 150 qualified biologists are available for inspection. **To enable the Placement Service** to render efficient service to employers and registered candidates, please register openings with this office.

The 1961 Placement Service Directory will be available in January, at a nominal fee of $1.00. The publication lists over 125 resumes of the qualifications, etc., of biologists seeking positions.

Biologists seeking assistance in placement are invited to register with the AIBS Placement Service at any time of the year, whether or not they have a membership in an AIBS Member or Affiliate Society, or the Institute. For further details, please write directly to the AIBS Placement Service, 2000 P Street, N.W., Washington 6, D. C.

ONR Activities

Charles D. Cox, son of C. A. Cox of Danville, Illinois, and husband of the former Ruth K. Swartz of Albion, New York has been appointed **Head of the Microbiology Branch of the Office of Naval Research, Washington, D. C.** The Microbiology Branch of ONR plans and administers contract research programs in several areas including **bacteriology, mycology, parasitology, virology, epidemiology and immunology.**

Dr. Cox received his B.S., M.S., and Ph.D. degrees from the University of Illinois. He has held teaching positions at the Medical College of Virginia, Pennsylvania State University and the University of South Dakota.

The AIBS is cooperating with the **Office of Naval Research** and the **Society of American Bacteriologists** for the **Symposium on Marine Microbiology** to be held on April 20–24, 1961, at the Morrison Hotel, Chicago, Illinois.

The Office of Naval Research has made this first meeting possible through financial support and interest in this fundamental aspect of Marine Science. The primary aims of the meeting will be to stimulate interest in marine microbiology through open discussions of current research, and to discuss areas of marine microbiology which need more active research.

Dr. Carl H. Oppenheimer, Institute of Marine Science, Port Aransas, Texas is General Chairman of the Symposium.

The AIBS Advisory Committee on Biology to the Office of Naval Research met November 18–19, 1960, in Washington, D. C. During the two-day meeting the committee discussed and evaluated the scientific merit of twenty-two research proposals. Otto Schmitt, School of Physics, University of Minnesota presided. Edward Batschelet, Dept. of Mathematics, Catholic University of America, participated in the two-day meeting.

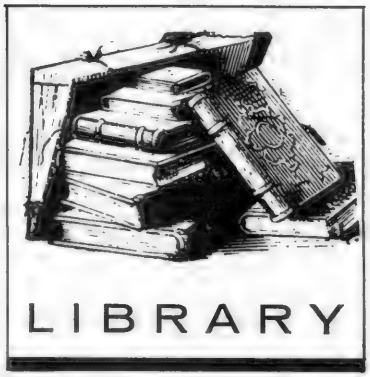
A booklet of fifteen research proposals was mailed to each committee member of the **AIBS Advisory Committee on Physiology to the Office of Naval Research.** The committee was asked to review and evaluate the scientific merit of the proposals. The committee's evaluation of each proposal was reported to the AIBS and a summary of their report was prepared and forwarded to the Physiology Branch, ONR. Dr. Hermann Rahn, University of Buffalo, is chairman of the advisory committee.

Under the sponsorship of the Office of Naval Research, the AIBS arranged for six European scientists to attend the XXV Cold Spring Harbor Symposium on Quantitative Biology, entitled "Biological Clocks". The Symposium was held June 5–14, 1960, at the Biological Laboratory, Cold Spring Harbor, New York.

Preparation of the Symposium Volume is in progress, and it is anticipated that the Volume will be available early in January, 1961.

AEC Activities

The **newly established AIBS Advisory Committee on Food Irradiation** to the AEC held their second meeting on December 5-6, 1960, in Washington, D. C. The specific mission of the committee is to evaluate and make recommendations to the Commission on matters relevant to food chemistry, microbiology and wholesomeness of irradiated foods. **Dr. B. S. Schweigert,** Food Science Department, Michigan State University, is chairman of the Advisory Committee and will preside at the forthcoming meeting. The committee members are as follows: **Drs. M. S. Read, Roger J. Romani, L. L. Kempe, S. A. Goldblith and H. Kraybill.**



One copy of each publication submitted for listing should be sent to the Editor, AIBS BULLETIN, American Institute of Biological Sciences, 2000 P Street, N.W., Washington 6, D.C. Only books published within a year of receipt will be reviewed. Books marked with a ★ are those published by Bulletin advertisers.

The Plasma Proteins. Vol. I. Isolation, Characterization, and Function. FRANK W. PUTNAM, ed. xv + 420 pp. Academic Press, New York and London. (1960) $12.50.

Since much of our knowledge of the structure, properties and functions of proteins has been derived from studies of the plasma proteins, this book, the first of two volumes summarizing the present state of knowledge of the whole plasma protein system, will be exceptionally useful as a reference work for all biologists interested in proteins. The individual proteins have been the subject of many reviews but this is the first integrated account of the entire system and the dynamic interrelationship of its parts. The present volume contains ten chapters on the physiocochemical aspects of plasma proteins, their isolation and characterization, and their functional differentiation. A second volume is planned which will deal with their biosynthesis, metabolism, and roles in the normal state and in disease.

It is always a difficult task with multiple authorship to produce a book that is uniformly good and is comprehensive without duplication. These authors, under the editorship of Dr. Putnam, have been unusually successful in achieving this aim, and the chapters have frequent cross references. The current methods for the isolation and characterization of proteins are detailed in the first five chapters. Chapters on plasma albumin by J. F. Foster, γ-globulin and antibodies by R. R. Porter, Macroglobulins by H. G. Kunkel, Glycoproteins by R. H. Winzler and Metal-

binding proteins by C. B. Laurell complete the first volume. There are extensive author and subject indices. The chapters contain a wealth of data conveniently tabulated which will be most useful to investigators in the future. *Claude A. Villee, Harvard Medical School.*

Progress in the Biological Sciences in Relation to Dermatology. ARTHUR ROOK, ed. 480 pp., illus. Cambridge University Press, New York. (1960) $15.00.

This book is a symposium of 37 papers by distinguished scientists, following closely the program of a course for practicing clinicians given in the Post-Graduate Medical School of the University of Cambridge in September of 1958. The course was designed to provide for the physicians in easily understood form information on significant advances in fundamental research in basic sciences related to their field of dermatology. The book is divided into eleven sessions, each session containing the full texts of two to five papers and the edited and abridged reports of the lively discussions between the basic scientists and the clinical dermatologists which followed each session. Understandably there was no attempt to provide a comprehensive review of all of the voluminous literature or of all of the progress in all biological sciences bearing pertinent relation to dermatology. Consequently, many of the topics of importance in dermatology which were already accessible in recent symposia or monographs were neglected in favor of the inclusion of less accessible topics or areas in which important advances were being made currently and which seem to be especially fruitful for future dermatologic research and clinical progress. Nevertheless, the book deals competently with many areas of this extensive field and contains sessions on melanogensis, cutaneous innervation, histochemistry of skin, bacteriology and mycology, psychophysiological mechanisms, comparative dermatology, immunologic aspects, inflammation, carcinogenesis, radiation effects, and the pharmacology of skin. The book is generously illustrated with diagrams, drawings, photographs and photomicrographs; it is generally well-written and well-edited, and it contains both subject and author indices. This is a valuable book which has achieved substantially the purpose of integrating medical science with the clinical practice of dermatology. *George W. Casarett, University of Rochester School of Medicine and Dentistry.*

Palms of the World. JAMES C. McCURRACH, xxxv + 290 p., illus. Harper & Brothers, New York. (1960) $17.50.

Few other groups of plants are more intimately associated with the history of man than the palms. However, except for a relatively few interested amateurs, and perhaps an even fewer number of botanical specialists, the palms are poorly known other than as objects of religious significance, and as the source of the date fruit. The author has written this volume chiefly for the cognizance of his fellow laymen, especially those of the palm-lover's cult, and not for botanical specialists. Nevertheless, even to the botanist who would normally shy away from this difficult-to-collect group, author McCurrach's work will make a delightfully painless introduction to the Palmae.

The introductory chapter is largely devoted to a discussion of nomenclature, economic importance, and notes on the culture of palms in the United States. The illustrated glossary which follows is dedicated to the peculiar aspects of palm structure. Most of this deals with vegetative portions as, "Palm flowers are usually tiny and insignificant and a technical description would be difficult for any but the trained botanist to follow."

In the remainder of the volume, the different kinds of palms are alphabetically arranged by genus. Depending upon current knowledge, and prevalence in gardens, more or less space is devoted to each genus. In a complete description, each genus is defined in general terms, interesting subjects being emphasized as the case demands. Where genera are common in cultivation, or are of particular economic or botanical importance, the author may discuss one or more species. For each species, a common name is stated, and the geographic origin is given. The arrangement of sexes, form of the trunk, structure of petiole and blade, shape of the flowerstalk, and a non-technical description of flower and fruit are also included under the discussion of species. Often species descriptions will cover methods of cultivation based on practical experience and sometimes a section on oddities will be included. The author has made a special point of indicating where certain species are currently being cultivated and has placed several lists of gardens at the end of the book. Illustrations are profuse and of good quality, and there is no page on which at least one illustrative photograph is not present. A helpful list of valid palm genera compiled by Burret and Potztal is included as an appendix to the volume.

Naturally in a volume of this size there are inevitable misspellings, oversights, and ambiguities. As examples we see "Cyclads" for Cycads, and "Mr. Theo K. Just" for Dr. Theodor K. Just. On page 172 we read that the genus *Pholidostachys* is native to Costa Rica, and that the description of *P. pulchra* is taken from that in Standley's *Flora of Costa Rica.* Nevertheless, in the legend accompanying the illustration of *P. pulchra* the querulous reader sees that the species is noted as Malayan. It would perhaps not be too much to ask, even in a volume intended for the layman, that the names of species be followed by the names of the authorities. The bibliography which terminates the work makes no pretense at completeness, but there are a number of incomplete and improper citations which should be corrected in the next edition of this work.

There are many who, along with the reviewer, will welcome this volume as a useful addition to botanical and horticultural literature. Author McCurrach is to be complimented for producing a very fine book. *William L. Stern, Division of Woods, U. S. National Museum.*

Developments in Industrial Microbiology. The Society for Industrial Microbiology, ix + 267 p.; illus. Plenum Press, New York. (1960) $7.50 (domestic), $9.00 (foreign), $6.00 to SIM members.

Based on the program organized by Paul Klens for the 16th General Meeting of the Society for Industrial Microbiology, a happy coincidence of thoughtful planning and courage to publish are illustrated by this book. The first in a proposed new series this volume supplements existing efforts in the field of microbiology in that it very ably brings to the microbiologist and his team in industry, many phases of industrial microbiology not treated in any of the similar series.

A roster of specialists in ten subject areas of interest to the practicing microbiologist cover a varied group of subjects. These begin, appropriately, with a consideration of the microbiologist himself, in terms of his training, as interpreted both by his teacher and his employer. Technical considerations of selfsanitizing agents for fabrics, antitumor antibiotics, hallucinogenic fungi, deterioration of proteins, destruction of wood by lower fungi, fungal metabolism and fungicides, variation in microorganisms, and an interesting ultra-contemporary subject entitled

"Space Age Microbiology," follow in clean array. Noteworthy non-conventional forays, in addition to space microbiology are represented by bioengineering, cellulolytic marine fungi, "mycopsychopharmacology," and oil field waters bacteriology. An interesting bit of poetical whimsy, "Microbiologica mutabilis," is also worth noting.

Although relatively modest in cost, the book is adequately bound and presents a pleasant photo offset printed page. Only a few typographical errors were noted and some of the illustrations were reduced too much for legibility. The absence of an index is a far more serious fault in a publication destined to be reference material in the personal, industrial and public library. Correction of this oversight is imperative.

Developments in Industrial Microbiology can be used profitably by the student entering the field of industrial microbiology, and the practicing microbiologist in industry, regardless of whether his specialty is in enzymology, biodeterioration, pharmacy and medicine, bioengineering, microbial physiology, genetics, chemical control, or just plain academic exploring.

This book, too, with its interesting price schedule and other features can serve to encourage various small, specialized, professional groups to publish their more formal deliberations. *Walter M. Bejuki, Prevention of Deterioration, Center, National Academy of Sciences, National Research Council.*

Progress in Industrial Microbiology. Vol. I. D. J. D. HOCKENHULL, ed. 248 p., Interscience Publishers, New York. (1959) $8.00.

The field of industrial microbiology which has come into great prominence within the last twenty years has been the product of the combined effort of bacteriologists, engineers, chemists, botanists and professionals from other ranks. For this reason, the organization of the field itself and its literature has not developed as rapidly as other less diverse subject areas. The collection and organization of the literature in industrial microbiology began with the introduction of the Journal of Applied Microbiology a few years ago. This has now been followed with the Journal of Microbiological Technology and Engineering. The Society for Industrial Microbiology has just gone into the second volume of its bound annual proceedings and, last year, a collection of review papers in book form, "Advances in Applied Microbiology" appeared. Now, another contribution is added to the literature under the title *Progress in Industrial Microbiology, Volume 1.*

This is the first volume of a projected annual series. Printed in England, it contains four reviews by English authors, one by American, and one by Italian, each about 30-60 pages.

The editor presents the first review, on the biosynthesis of penicillin. He deals largely with his own area of special competence, the development of biochemical knowledge from studies of media. Beginning with the historic breakthrough in the discovery of enhanced yields of penicillin with corn steep liquor, he follows historically the studies with chemically defined media including phenylacetic acid. Work to clarify the special effectiveness of lactose sugar is well presented. The two sections that follow discuss the biosynthetic mechanisms of synthesis of penicillin and its component parts through reaction of specific precursors and the subsequent combination of the moieties produced. The considerable research that has gone into these studies and the speculations derived therefrom is fully reviewed and analyzed.

Similarly competent reviews follow on the morphology of saprophytic actinomycetes by K. A. Bisset of the University of Birmingham; fermentation of the tetracyclines by A. DiMarco and P. Pennella of Laboratori Ricerche Farmitalia, Milano; microbiological assay by W. T. Sokolski and O. S. Carpenter of the Upjohn Company; microbial synthesis of riboflavin by T. W. Goodwin of the University of Liverpool; and microbial fat by M. Woodbine of the University of Nottingham.

Since this volume is not meant specifically for those in one discipline, the style as well as the content of the chapters varies. The chapters on the tetracyclines and on microbiological assay are essentially practical in nature while those on biosynthesis are approached from a more fundamental basis. The different professionals of industry and the academic areas working in this widely expanding field of industrial microbiology should find valuable common ground in this useful new volume and the series to follow. *S. S. Block, Department of Chemical Engineering, University of Florida.*

The Bacteria, A Treatise on Structure and Function. Volume I: Structure. Edited by I. C. GUNSALUS and ROGER Y. STANIER. vix + 513 p. Academic Press, New York. (1960) $13.00.

This is the first volume of a series of five volumes dealing with modern knowledge of the biological properties of bacteria. The present volume, as indicated by the title, is devoted to bacterial structures, subsequent volumes will be concerned, respectively, with: energy-yielding metabolism; biosynthesis; growth and general physiology; and heredity.

As stated in the preface by the editors, we have witnessed, during the past twenty-five years, a radical change in the science of bacteriology: "Although the applied aspects of this science have continued to grow, there has emerged a vigorous and widespread interest in the bacteria as biological entities. This originated historically from the realization of the fundamental unity of biochemical processes in living organisms, coupled with the recognition that bacteria provide ideal experimental systems for the investigation of many biochemical problems."

The study of bacterial cytology represents one of the most dynamic contemporary areas of this science. This volume brings together, in a very scholarly fashion, the vast amount of data accumulated in recent years on bacterial structures and their physiological implications. It is the most thorough and comprehensive effort to date to integrate modern knowledge of bacterial cell structures, their anatomical site and properties, with physiological function.

There are ten contributors to this volume, each of whom has authored a chapter as follows: 1) The Bacterial Protoplasm: Composition and Organization, S. E. Luria; 2) The Internal Structure of the Cell, R. G. E. Murray; 3) Surface Layers of the Bacterial Cell, M. R. J. Salton; 4) Movement, Claes Weibull; 5) Morphology of Bacterial Spores, Their Development and Germination, C. F. Robinow; 6) Bacterial Protoplasts, Kenneth McQuillen; 7) L— Forms of Bacteria, E. Klieneberger-Nobel; 8) Bacterial Viruses — Structure and Function, Thomas F. Anderson; 9) Antigenic Analysis of Cell Structure, E. S. Lennox; and 10) Localization of Enzymes in Bacteria, Allen G. Marr.

This volume contains a large number of very excellent photomicrographs. There are also numerous schematic diagrams which facilitate the comprehension of concepts being presented. Considerable detailed information is presented in tabular form. Each chapter is heavily documented with references, e.g., Chapter 3 (Surface Layers of the Bacterial Cell, M. R. J. Salton), 284 references cited; Chapter 4 (Movement, Claes Weibull), 291 references cited. The sum total of references for the ten chapters is 1,525! A casual scanning

of the reference list reveals a large proportion of them as publications dating in the 1950's, which again reveals the tempo of research in this area. The reader is impressed by the tremendous task performed by each author, not only in bringing together the contributions of a great many investigators but also, more significantly, in organizing this vast amount of "new" data, observations, and speculations. In fact, a thread of "unity and cohesiveness" appears extant through the ten chapters albeit they are authored by ten different individuals.

This volume is doubly indexed, both by author and subject; and each of these is very comprehensive.

The editors are to be commended for their vision and courage in undertaking an enormous task. The authors of the present volume are to be complimented for the excellent presentations of their special topics. *Michael J. Pelczar, Jr., Department of Microbiology, University of Maryland.*

Lobund Reports. Germfree Life Studies, No. 3. Edited by James A. Reyniers, Robert F. Ervin, Helmut A. Gordon, and Morris Wagner. 182 p., illus. University of Notre Dame Press, Notre Dame, Indiana. (1960) $2.50.

The third *Lobund Report* on germfree life is introduced by a resume of the pioneer studies in this field by Rudolph W. Glaser. The work of Glaser dealt with a number of invertebrates which included house flies, cockroaches, and protozoa. The Notre Dame group has worked with vertebrates including rats, chickens, dogs, and others.

The bulk of this report deals with the white Wyandotte Bantam and the White Leghorn chicken. The general methods of incubation, hatching, testing, feeding, and autopsy are given. A detailed report of a morphological and biochemical comparison of germfree and conventional animals is given. The reviewer was surprised at the general lack of differences between the two groups of animals, except for those tissues normally in contact with the intestinal flora. The serological part of the survey showed a delayed appearance of agglutinins to bacteria sterilized in the diet and absence of agglutinins to certain intestinal organisms.

The survey closes with a report that certain germfree vertebrates can be reared free of animal parasites by the methodology that has been developed and also that turkeys can be reared germfree. *S. G. Knight, Department of Bacteriology, University of Wisconsin.*

The Biology of Marine Animals. J. A. COLIN NICOL. 707 p., illus. Interscience Publishers, Inc., New York. (1960) $14.00.

This is a text on the comparative physiology of marine animals, written for the undergraduate specializing in marine zoology and for the university biology student undertaking studies at the seashore. Chapters deal successively with the environment, water and minerals, body fluids and circulation, respiration, nutrition and feeding mechanisms, digestion, excretion, sensory organs and reception, effector mechanisms, nervous systems and behavior, pigments and color, color changes, luminescence, intimate association between species, and skeletons, shelters, and special defences. The chapters are concise summaries, usually well-illustrated and fortified with tabulated data, and documented with extensive references to recent literature, mostly in English.

The book has several refreshing features. The author, a zoologist at the Plymouth Laboratory, has managed to combine the viewpoints of naturalist and experimentalist, of physiologist and ecologist. He deals with both vertebrates and invertebrates, not only in terms of tissues and organs but also in terms of whole organisms operating in an environment. Physiology is broadly construed to include function of many sorts, and while a basic knowledge of anatomy and biology are assumed, no sharp line is drawn between physiology and related or background fields. The result is a physiology text flavored with functional anatomy, physiological ecology, behavior, and natural history, such that physiological significance is enhanced and the term "biology" in the book title is not misleading. Only the function of reproduction is neglected, and it would seem desirable to include in later editions a chapter on the physiological aspects of reproduction and reproductive cycles. *Donald P. Abbott, Hopkins Marine Station of Stanford University.*

A Guide to Freshwater Invertebrate Animals. T. T. MACAN. 118 p., illus. Longmans, Green and Co., Ltd., London. (1959) $3.00.

In a small volume intended for amateur naturalists and professional biologists, Macan aims by means of keys to enable collectors of freshwater invertebrates to identify their catches to the nearest group. Nearest group may mean phylum, class or, more frequently, order or family. References to detailed studies for specific indentifications are provided.

The "guide" appears to have fallen between two stools—insufficient basic information for the amateur and insufficient detail for a really useful volume for the professional biologist.

Macan is inconsistent in that after recognizing that amateur collectors may not have access to first class microscopes, he describes such minute anatomical features as flame cells of rotifers and planarians. Or again, metamorphosis of copepods is noted and naplius instars described, but no mention is made of the copepodite instars. Also one wonders how generally available to amateur naturalists are the cited references.

The 202 illustrations vary from diagrammatic line figures to excellent stiple drawings. Arthropods occupy 78 pages of which 62 (more than one half the volume) are devoted to insects. The book is attractively printed and nearly free from typographical errors. The words "small" and "big" appear to have been interchanged in the paragraph on the top of page ix.

Directed primarily to students of the British freshwater fauna and giving references to works chiefly concerned with European forms, Macan's book will probably prove to be of limited value to serious students of North American freshwater invertebrates. *E. B. Reed, Department of Zoology, Colorado State University.*

Man High. DAVID G. SIMONS (MC) USAF with DON A. SCHANCHE. 262 p. Doubleday & Company, Inc., Garden City, New York. (1960) $4.50.

This is a well written, popularized, but informative account of the circumstances surrounding the record 102,000 ft. balloon ascent made by Lt. Col. Simons in August 1957 and the effect the experience had upon the design of the current Project Mercury. Remaining for 32 hours above 98% of the earth's atmosphere Project Man High reconfirmed both the intimate link between man and the terrestrial environment, and the inherent resistance of the human body and spirit to acute environmental stresses. In this day of almost routine rocket soundings which probe the nature of space, weather and communication satellites, and orbiting bio-packs there is a temptation to consider the pioneering endeavors of Project Man High as an adventureous excursion that provided very little new scientific information for the effort involved. However, the purposeful collection of micro meteoritic dust on the capsule exterior; photometer readings which provided measures of the dust in the upper atmosphere; cosmic ray measurements and indications that heavy primary cosmic radiation may not be acutely hazard-

ous to man; pioneering efforts at biomedical telemetering; and the measure of man's ability to perform analytical tasks under the stress of isolation and artificial environments were unique data vital to the urgent preparations for manned orbital flight which began following the Russian demonstration of Sputnik I.

The presentation suffers somewhat from the lack of illustrations but is, nevertheless, an exciting narrative of a space age adventure. *Robert G. Lindberg, Bioastronautics Laboratory, Astro Systems and Research Laboratories, NORAIR Division, Northrop Corporation, Hawthorne, California.*

Physics and Medicine of the Atmosphere and Space. Editors, OTIS O. BENSON, JR., HUBERTUS STRUGHOLD. 642 p. John Wiley and Sons, Inc., New York, London. (1960) $12.50.

"This book is the record of the Second International Symposium on the Physics and Medicine of the Atmosphere and Space." As such it is a collection of forty-two technical papers by recognized authorities dealing with the physical and chemical nature of space and planetary environments; life on other planets and the biological consequences of extra-terrestrial stresses such as weightlessness, ionizing radiations, sensory deprivation, and artificial environments; astrodynamics; engineering design of manned vehicles; and problems of rescue and retrieve missions.

The papers dealing with biological problems of space habitation while concerned with specific areas tend to reflect the philosophy that analytical tasks will be defined which will require manned space flight for their execution. The longer the duration of projected manned space missions, or the more analytical the task man is to perform, the more closely must the life support system simulate a terrestrial environment. A paucity of definitive data regarding the ways in which specific environment factors effect living systems suggests that the successful exploitation of space by humans, whether as a solace to their intellectual curiosity or as a military deterent, will be highly dependent upon knowledge gained from very fundamental biological research both in space and in the terrestrial laboratory.

Astronautics has reaffirmed, once again, the inter-relationship between the physical and biological sciences. However, as justified as the interdisciplinary approach may be there is some risk in attempting to represent several disciplines in one text. It will be an unusual reader, for example, who will be able to follow with equal comprehension Hurtado and Clark's paper on "Parameters of Human Adaptation to Altitude," Nicolet's paper on "Aeronomic Chemical Reactions," and Petersen's paper on "Rescue and Retrieve Missions."

For the most part the papers presented are of a review nature technically accurate with ample references. Several of the papers are particularly useful as reviews of research sponsored in government laboratories which has not yet reached the open literature. The book is certain to be a key reference for those concerned with the space effort, but its impact would have been much greater had its publication not been delayed eighteen months. The editors should be complimented on the continuity achieved from such a diverse offering. *Robert G. Lindberg, Bioastronautics Laboratory, Astro Systems and Research Laboratories, NORAIR Division, Northrop Corporation, Hawthorne, California.*

The Head, Neck and Trunk: Muscles and Motor Points. DANIEL P. QUIRING and JOHN H. WARFEL. 2nd Ed. 124 pp., 109 illus. Lea & Febiger Co., Philadelphia. (1960) $3.25.

The striated muscles of the body regions referred to in the title are portrayed in individual, uncluttered diagrammatic drawings. The illustrations include clearly labelled innervation and arterial supply. The Latin name of each muscle appears as the caption, and beneath each drawing are listed succinctly the origin, insertion and function, as well as nerve and chief arterial supply, and in addition references to the 27th edition of *Gray's Anatomy* and the 9th edition of *Cunningham's Textbook of Anatomy.*

The index is divided into sections: Arteries, Muscles, Nerves, markedly facilitating its use by the anatomy students, surgeons, physical therapists and dentists to whom the book is addressed. Perhaps its greatest shortcoming is the extreme meticulousness with which the muscles in the drawings have been divested of their neighbors in the avowed interest of clarity. However, when used in conjunction with the reference texts, this should not prove an insurmountable obstacle. *Leonard Nelson, Emory University.*

New Developments in High School Science Teaching. The National Science Teachers Association, 1201 Sixteenth St., N.W., Washington 6, D. C. 108 pp. (1960) $1.50.

In 1958, a committee of the National Science Teachers Association undertook the task of compiling a list of new practices in science teaching as carried on in secondary schools over the country. A questionnaire was sent out to selected schools, asking the teachers to describe whatever special courses were being given. This book is a compilation based on analysis of these questionnaires.

Some of the procedures described are strictly administrative methods of extending the school program to include after school classes, Saturday classes, summer institutes, field trips, summer science camps, before school seminars, etc. However, many schools described special courses. While some of these were college level courses for advanced standing, others were planned expressly for secondary school students but with different content, or different approach from the standard.

A separate chapter of the book is devoted to courses in each of these areas:—General Science, Earth Science, Biology, Fused Physical Science, Chemistry, Physics. One chapter deals with science seminars as an adjunct to science teaching. Each course is described briefly, but an appendix tells where to get more information about many of the courses. There are subject matter courses, technique courses, experimental courses which hope to introduce students to the art of doing research, field courses, etc. The course types vary as widely as the imaginations of the science teachers who created them.

This book, then, is a useful source of ideas for every science department which is looking for something new. Certainly, one of the hundred or so ideas presented can be the precursor of an even better course or a better idea. As the book states, "It is not intended that the programs described . . . be lifted in toto and substituted for existing programs. Rather the needs of the local situation should be studied carefully . . . and then . . . the appropriate new developments be selected and modified to meet the needs . . ." *Philip Goldstein, Chairman, Department of Biology, Abraham Lincoln High School, Brooklyn, N. Y.*

***Handbook of Microbiology.** MORRIS B. JACOBS and MAURICE J. GERSTEIN. 322 pp. D. VanNostrand Company, Inc., Princeton, New Jersey. (1960) $8.50.

Various types of microbiological data are provided in tabular form. Approximately one-half of the book is devoted to characteristics of 159 micro-organisms including bacteria and several molds, yeasts, and rickettsia. In each case information is given relating to taxonomy, cellular, cultural, biochemical, and physiological characteristics, fermentation reactions, and pathogenicity.

In another table 256 antibiotics are listed with a brief description for many that sometimes indicates the chemical nature, source and effectiveness against particular organisms.

Very brief descriptions are given for 128 culture media and methods, 21 indicators, 77 microbiological reagents and tests, and 108 stains and staining technics. Other tables are devoted to temperature conversions, saturated steam temperatures, most probable numbers, phenol coefficients, *Shigella* serotypes and the Kauffmann-White schema of *Salmonella* serotypes.

One section of the Handbook includes tables with titles relating to some bacterial diseases of human beings and animals, some viral diseases of human beings, Arbo (arthropod-borne animal) virusus, and some rickettsial parasites of human beings and animals.

Sections relating to the differentiation of various organisms such as brucella, clostridia, staphylococci, and streptococci appear to be of limited value as do other tables relating to toxins and antitoxins.

The format of this Handbook is excellent, and even the tables containing a great deal of information are easy to read. The authors indicate that the purpose of this book is to provide practical information for bacteriologists, biologists, serologists, immunologists, mycologists, sanitarians, physicians, public health scientists, chemists, and many others. It is probable that this Handbook will be of most value to those not specializing in microbiology, since they are unlikely to have unabridged volumes in their laboratories relating to the subjects covered.

This Handbook is an attempt to bring various types of microbiological information together and the authors indicate in their preface that they would welcome suggestions for other phases which should be included. Undoubtedly they will receive some. *William G. Walter, Department of Botany and Bacteriology, Montana State College.*

The Search for New Antibiotics. G. F. GAUSE, 97 p, illus. Yale University Press, New Haven. (1960) $4.75.

Professor Gause is attempting to direct the search for new antibiotics on an improved rational basis. He defines three principles to guide the search: 1) analysis of distribution of microorganisms on the basis of geography and ecology, 2) early classification of isolated microorganisms, and 3) the selection of test organisms that can inhibit specifically pertinent biochemical mechanisms and thus permit rapid selection of antibiotics.

Professor Gause has been guiding a group of investigators in assembling data that permits an evaluation of the validity of these three principles. Thus, much of the data are well coordinated for the desired analyses. At the same time, the scope of operations has not been limited. Thus, in studies of geographic distribution, soil samples have been obtained from Central Asia and South America, as well as the various areas of Russia. Russia itself offered a wide range in conditions of temperature and climate. A greater variety and higher proportion of antagonists are found in the zones of warmer areas, but the generalization cannot be extended to individual antibiotics. Penicillin producers, for example, are more frequent in the north than in the south.

Professor Gause emphasizes that, in general, production of specific antibiotics is a characteristic of species or varieties of species of organisms. Therefore, early recognition of species should lead to more efficient screening. To help the situation, a specific medium has been suggested that is favorable toward cultivation for taxonomic study. In the direction of further reduction to practice, Gause notes that on this basis, a new taxonomic unit has been recognized among the actinomyces that may be a favorable source for new antibiotics.

A major portion of the monograph is devoted to the use of microorganisms in cancer research. In agreement with Julian Huxley, Gause would use "wide biological nutcrackers," such as effects on respiration as described by Warburg and others following Warburg. Gause postulates that many microorganisms might be found that may be biologically equivalent to cancer cells. Test cell types are discussed such as yeast mutants with impaired oxidative mechanisms, and from Gause's own laboratories, staphylococci with decreased respiratory quotients. In accord with this hypothesis, known antitumor agents inhibited selectively such staphylococci. Gause and co-workers have collected a variety of data supporting his hypothesis. They have used a number of experimental procedures that encompass recent advances in biochemistry. Several nitrogen mustard derivatives and other biological alkylating agents acted in accord with the hypotheses and the agreement also extended to antibiotics and antimetabolites.

The presentation is organized in coherent, logical sequence that is both easy and interesting to follow. The choice of reference material was made with care, and burdensome overwhelming presentation of details was avoided. The monograph can be read profitably by a wide audience that extends beyond workers actually engaged in the field of antibiotics and cancer research. *Morris Solotorovsky, Department of Bacteriology, Rutgers University.*

Aquatic Phycomycetes. FREDERICK K. SPARROW, JR. 2nd revised edition. xxv + 1187 p., 91 figs. University of Michigan Press, Ann Arbor. (1960) $22.50.

The first edition of Sparrow's *Aquatic Phycomycetes*, which appeared in 1943, immediately became the standard reference work in the field, and it has continued to stimulate the advance of research on these primitive fungi. The thoroughly revised second edition is a fitting successor to that distinguished volume.

This is more than a taxonomic monograph. It is apparent that the author has attempted to bring together all pertinent knowledge of these taxa, and that he has largely succeeded. Phylogeny, relationships, distribution, collection, isolation, and culture methods are discussed in a much expanded introduction, and each of the major taxa is introduced with a discussion of current knowledge of morphology and development, cytology, genetics, and physiology. If physiology is considered in less detail than other aspects, the relevant literature is cited in context and included in the valuable sixty-page bibliography.

The coverage is approximately that of the first edition, with several helpful additions. These include species described subsequent to standard monographs in several groups (notably, the Saprolegniaceae and the Pythiaceae) and inclusion of the aquatic Entomophthoraceous genus *Ancylistes*.

Sparrow's concept of phylogeny and his systematic treatment have not changed materially from those presented in the first edition. He recognizes one additional suprageneric taxon, the Gonapodyaceae. The keys are sometimes difficult, but this reflects upon our inadequate knowledge and the large number of described species in many taxa (e.g., *Rhizophydium*, with 110 recognized species) rather than on the author.

This is a weighty volume in more than one sense of the word, and its bulk is something of a disadvantage. Weighing upwards of six pounds, Sparrow's manual is available at approximately $4.00 per pound. It's a bargain at the price. *Robert M. Johns, Department of Botany, Indiana University.*

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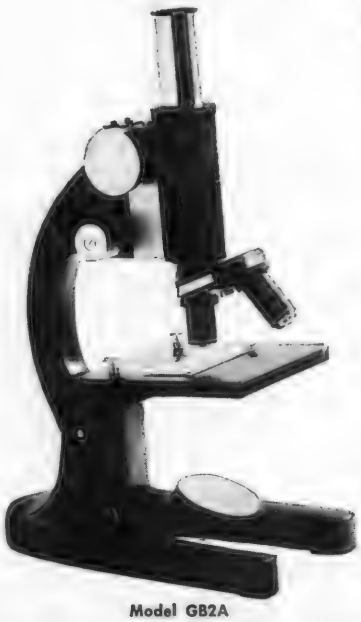

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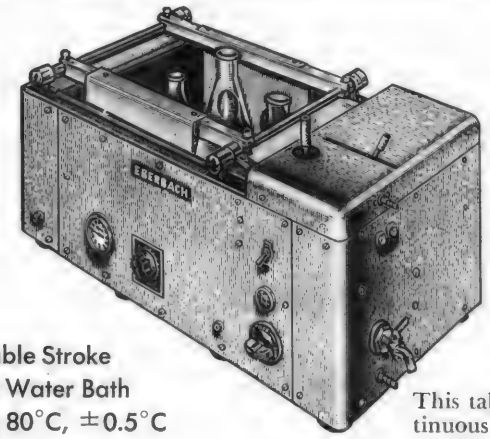

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By ISRAEL S. KLEINER, Ph.D.; and JAMES M. ORTEN, Ph.D. 1958, 5th edition, 808 pages, 6½" x 9½", 94 illustrations, 5 color plates. Price, $9.00.

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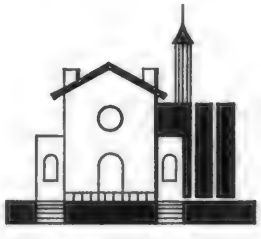

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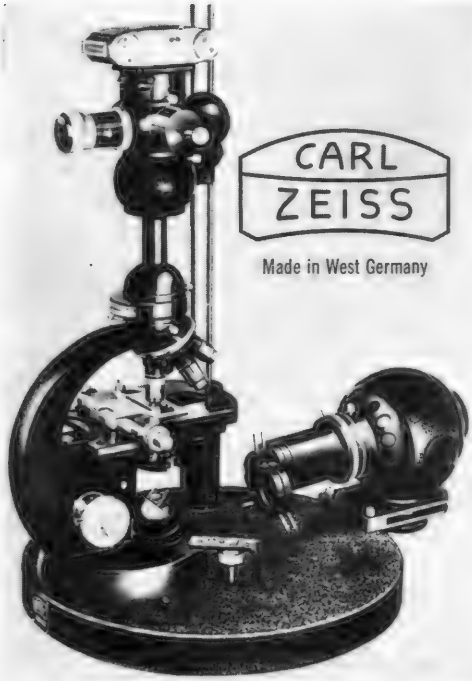

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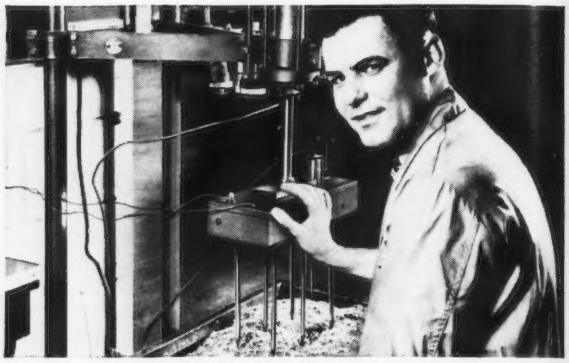

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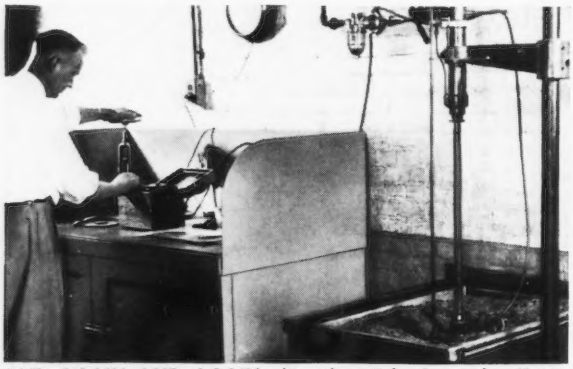

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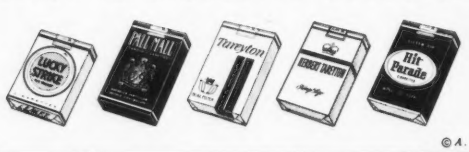

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